APRIL 1961

Heating Piping & Air Conditioning

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. . . for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings

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106-Acre

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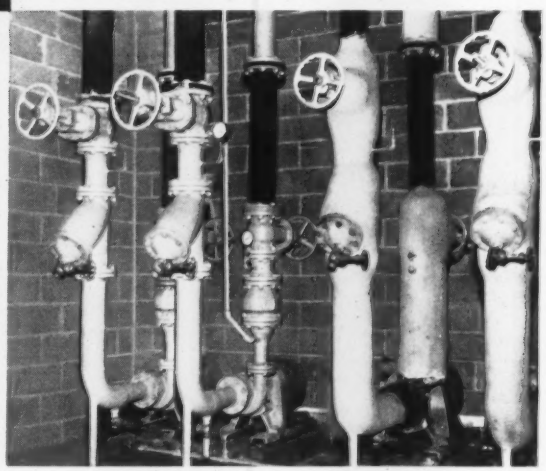

Valves on air conditioning system pumps.

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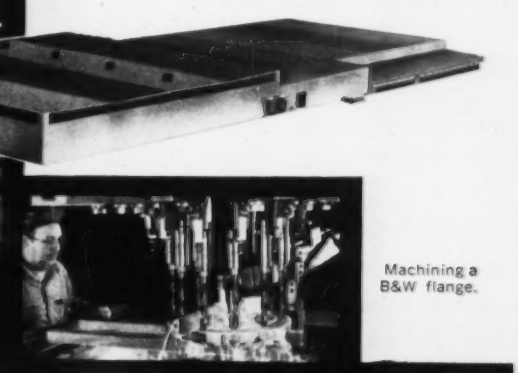
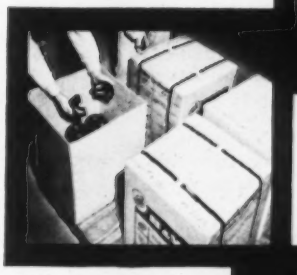
B&W's New Fittings Plant is in FULL OPERATION

One of the mill stock bays.

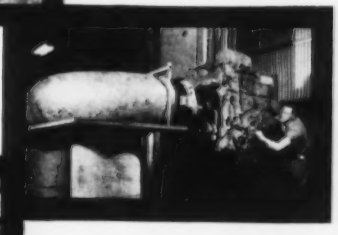


Machining a B&W flange.

Forging a tee.



Packing fittings for shipment.



Machining a 24" elbow

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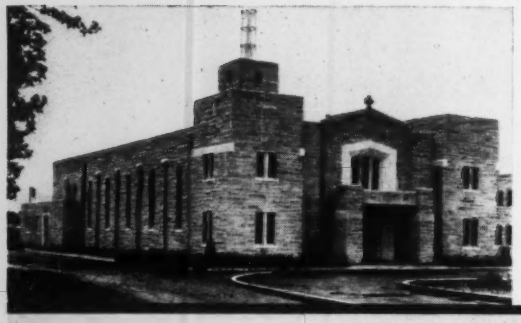

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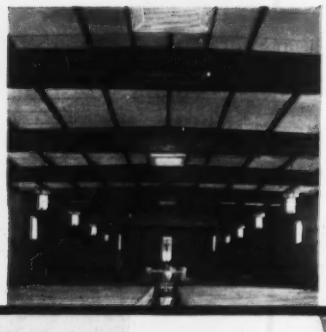

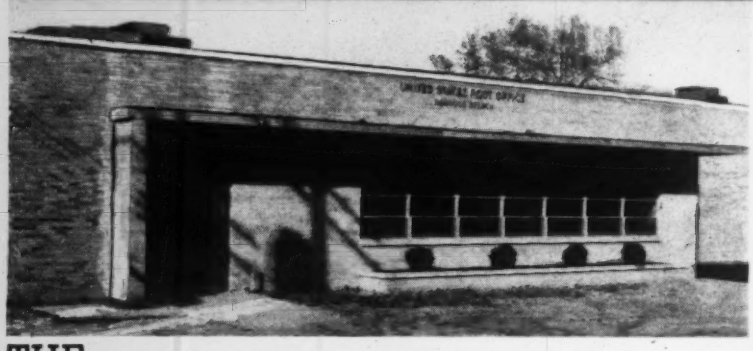

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FOR CONSULTING ENGINEERS, MECHANICAL (HEATING, PIPING, AND AIR CONDITIONING) CONTRACTORS, ENGINEERS WITH PLANTS AND BIG BUILDINGS

VOL. 33, NO. 4 APRIL 1961

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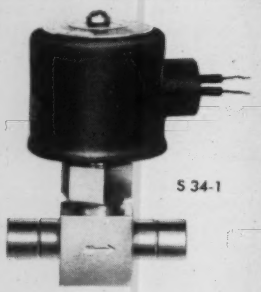
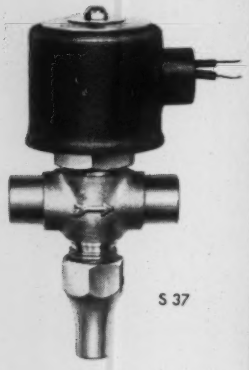


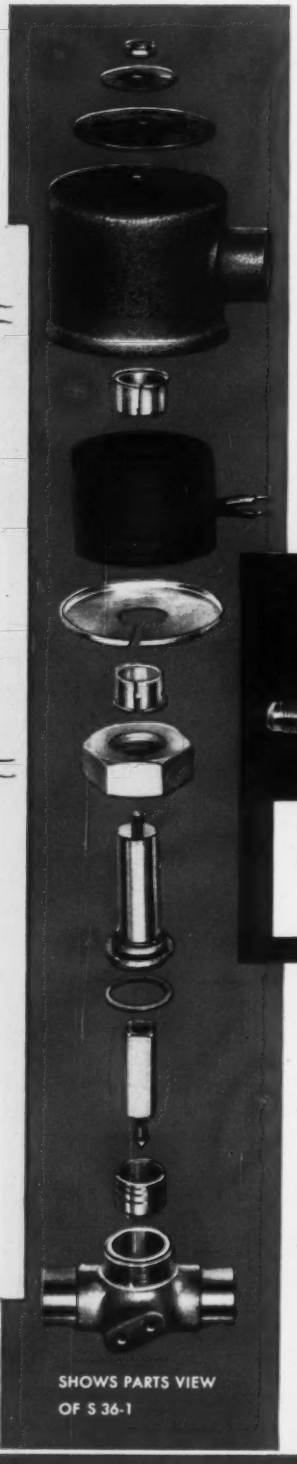
S 34-1

LINE CONNECTION SIZES
⅜ O.D.F. ⅝ O.D.F.
½ O.D.F. ½ S.A.E.
PORT DIAMETER: ¼

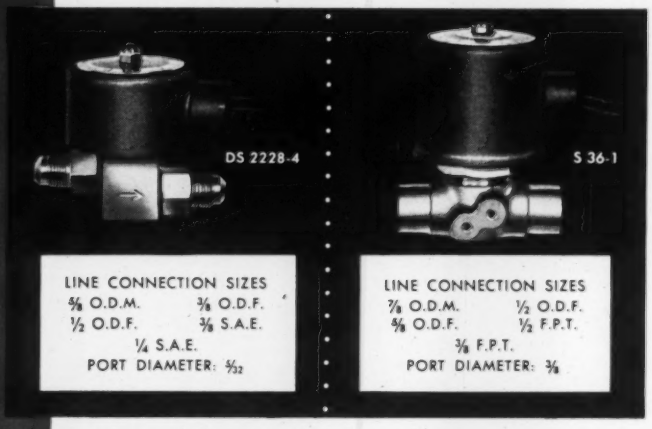


S 37

LINE CONNECTION SIZES
⅞ O.D.M. ⅝ S.A.E.
⅝ O.D.F. ½ F.P.T.
½ S.A.E.*
WITH OR WITHOUT MANUAL ADJUSTMENT STEM
PORT DIAMETER: 7/16
*Strainer Assembly Included



SHOWS PARTS VIEW OF S 36-1



LINE CONNECTION SIZES
⅝ O.D.M. ⅜ O.D.F.
½ O.D.F. ⅜ S.A.E.
¼ S.A.E.
PORT DIAMETER: 5/32

LINE CONNECTION SIZES
⅞ O.D.M. ½ O.D.F.
⅝ O.D.F. ½ F.P.T.
⅜ F.P.T.
PORT DIAMETER: ⅜

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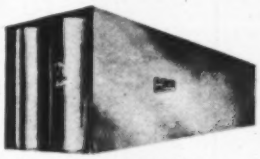
"Short Form" Makes Selection Easy

Since that time, because of the progress made in the design of Quiet-DUCT Silencers, and the wide acceptance of newly developed techniques mentioned above, the "Short Form" has been developed to make the selection of unit silencers for air handling systems an easy matter.



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4 LOW PRESSURE MODELS
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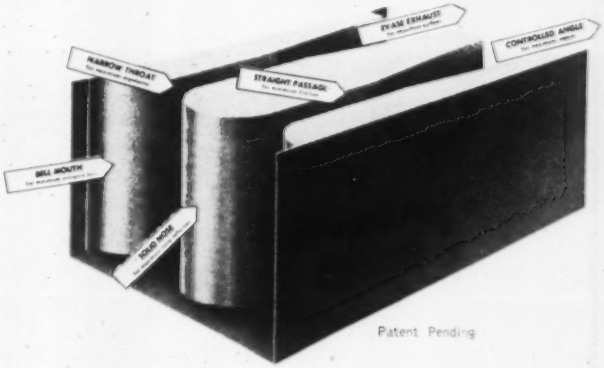
90 MULTIPLE UNIT SIZES

CONIC-FLOW SILENCERS
18 STANDARD UNIT SIZES

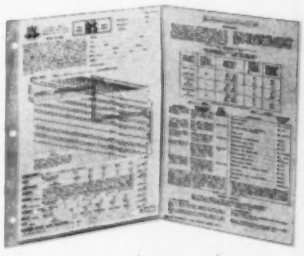
"Cut-Away" View Reveals New Design of "Packaged" Quiet-DUCT Silencers.



Over ten years of experience in controlling noise in air handling systems has resulted in this new, basic design for all "packaged" silencers manufactured by our company. Design requirements include: *Bell Mouth Entrance* for minimum air pressure loss; *Solid Nose* for maximum noise reflection; *Narrow Throat* for maximum noise impedance. *Straight Passages* provide smoother airflow with more silencing and less regenerated noise. *Less Pressure Drop* is achieved by the diverging design of the evasè exhaust, keeping turbulence at a minimum and attaining maximum pressure regain.

The "SHORT FORM" consists of a small binder containing a pad of 25 reproducible work sheets. Only one such sheet is necessary to quickly and accurately resolve each noise problem and determine whether silencers are required, and if so, the silencer model needed to provide the Noise Reduction required for the problem. The "SHORT FORM" gives the Noise Reduction required in the 3rd octave band (in decibels) based on the data and procedures published in the ASHRAE GUIDE & DATA BOOK. Many field experiences have demonstrated that 3rd band calculations, by themselves, are a reliable index to silencing requirements as related to air handling systems. Because of the inherent characteristics of the "packaged" Quiet-DUCT silencers — if silencing is required in the 3rd Band, and the unit silencer is selected based on this criteria, more than enough noise reduction will be provided for all other bands as well.

The "SHORT FORM" is available through our representatives or write direct.



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How Imaginative Engineering Provided Air Conditioning To Fit A School Budget

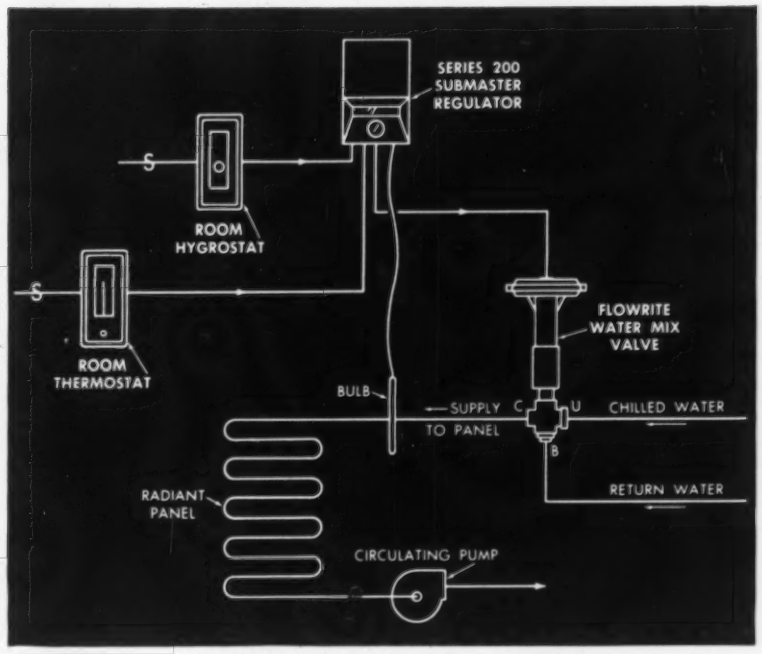
Must school air conditioning always be "too expensive"? Perkins & Will, Chicago architects and engineers, didn't think so last year when they designed suburban Homewood-Flossmoor High School. Without exceeding the school budget, they provided an air conditioned area large enough for complete summer sessions, including 15 classrooms, the library and all administrative offices. Actually, cooling for 25,000 square feet added less than 3½% to normal building cost — less than $4 per square foot of cooled area.

Homewood-Flossmoor High School, Flossmoor, Illinois. Air conditioned section (center) connects to other school facilities by glass-enclosed passageways.
Architects and Engineers: PERKINS & WILL, CHICAGO
Mechanical Contractor: THE ECONOMY PLUMBING AND HEATING CO. OF CHICAGO.

Perkins & Will team of architects and engineers works out details of the cooling system design features and controls for the Homewood-Flossmoor school. From left to right are F. Philip Brotherton, Designer and Project Architect; Rudolph J. Houkal, Chief Mechanical Engineer, and Edward C. Colin, Chief Structural Engineer.

How it was done

Perkins & Will grouped all rooms where both heating and cooling were desired into one section of the school. An interesting design feature is the core of 15 classrooms, surrounded on all sides by other rooms. The fuel savings realized from this "insulated" core help defray the added expense of cooling the entire summer school section. The engineers concentrated all mechanical service equipment beneath this section to eliminate long air conditioning channels. Double ducts and automatic controls were carefully designed for easy switchover to cooling and to take full advantage of tempered return air and outside air during spring and fall seasons.

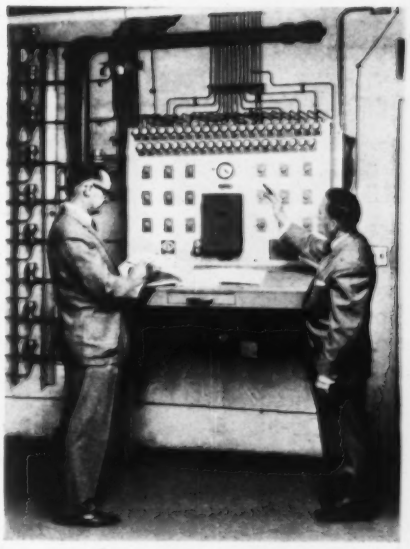


Ceiling Panel Condensation Control

To back up the mechanical efficiency it so carefully designed into the heating, cooling and ventilating system, the Perkins & Will firm specified a Powers system of pneumatic temperature control, including the important dew point control which acts on the chilled water auxiliary cooling used in rooms exposed to the outside. This control (see diagram) utilizes a Powers Water Mix Valve on the ceiling panel chilled water supply and a low limit Submaster Regulator. The Powers Hygrostat measures room humidity conditions and resets the low limit temperature to prevent condensation on panel surfaces, yet allows supply water temperature to be as low as possible for maximum cooling.

Fuel savings in all zones, including those not cooled, are maintained with Powers Day-Night zone controls. A 7-day program clock on the master control panel in the boiler room provides easy switching from day cycle to night cycle. This Powers pneumatic control panel automatically provides a 24-hour-a-day picture of temperature levels in all zones.

Write for the latest Powers Catalog of efficient, economical pneumatic controls for schools and other structures.



Homewood-Flossmoor Maintenance Superintendent William C. Drews (left), takes readings from the automatic Powers pneumatic control panel.

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LETTER FROM THE EDITOR

April 1961

Dear Reader:

The article, "Air Conditioning Design Beats Cost, Space Problems" featured on the cover and on pages 115 to 120 by Robert W. Flanagan discusses many interesting aspects of air conditioning a new addition to an existing office building. Mr. Flanagan shows how great the present day needs are for economizing in the amount of space required for the air conditioning system and the mechanical equipment and how these requirements were met in the Bankers Life Company home office addition in Des Moines, Iowa. Careful analysis and thorough planning prior to the design of each installation are the only ways in which costs and space can be reduced, according to Mr. Flanagan. He includes an interesting tabulation of comparative costs and decreasing space allotments for air conditioning equipment for the new addition and for the original building which was built and air conditioned about 30 years ago. This table proves the point that as building costs and equipment expense continue to rise, the demands on the mechanical engineer are increasing proportionately for less space and more economical systems.

Four viewpoints on various phases of design, installation, and operation of medium temperature hot water heating systems are presented in the article on page 121. Homer M. Bird discusses the system designs he has made in which the method of primary and secondary pumping is used. S. W. Miller, Jr. explains how to select terminal units for these systems, and G. F. Carlson points out what should be done to insure good life of the pumps. R. M. Harmon says the MTHW system is lower in first cost by about 20 percent than the LTHW systems based upon his experience. These four engineers spoke on this subject at the recent meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers in Chicago, and this article is based upon our notes made while attending the meeting.

To air condition the new Bank of New Mexico building in Albuquerque, a high velocity double duct system was selected because of its ability to provide flexibility. This was especially necessary in this case because of the extreme daily variation in outdoor temperatures and the relatively high solar load. Of course this solar load and wide temperature fluctuations were major factors in the design of this system, especially because of the large glass areas on the north and south exposures. Roger W. Haines explains how the system was designed in order to meet these requirements and how office space was saved at the same time in his article on page 126.

How to prevent corrosion in copper and copper alloy piping systems for hot and cold water distribution is carefully explained in the article by Dr. M. F. Obrecht and Dr. L. L. Quill on page 129. These recommendations have been based upon an extensive investigation at Michigan State University in cooperation with the Copper and Brass Research Association. This article is the seventh and concluding one in the series prepared by Dr. Obrecht and Dr. Quill, and I am sure you will find this information to be valuable in the design, installation, operation, and maintenance of these systems. The authors explain that each of the following factors must be considered in designing these systems in order to prevent corrosion: water velocity, water temperature, water quality, and the service demands on the system. Any two of the first three variables control the effect of the others. The authors point out in detail in this article what the design and operating limits are that will assure continuous and satisfactory service. This article and the previous six articles in this series will be reproduced in a booklet and will be available soon.

LETTER FROM THE EDITOR (continued) --

The use of a radiant ceiling panel heating system with acoustical control in the new Woodrow Wilson Junior High School has been found to make the building serviceable, quiet, and comfortable, according to W. M. Harju in his article on page 135. The building is divided into 12 individually controlled zones, each of which is served by a separate hot water ceiling panel system. No. 5 fuel oil is used to fire three packaged steam boilers. Steam is distributed through underground pipe in tunnels to the 12 mechanical equipment rooms where the heat in the steam is converted to hot water for the radiant ceiling panels. Ventilation of the various areas is controlled separately depending upon the use and conditions in each area.

Heat pump controls need careful design attention, according to Lester T. Avery in his "Tricks and Trends" feature this month on page 138. He relates some problems based upon his experiences with defrosting of coils and leaky check valves and what was done to correct these problems.

A useful heat transfer nomograph has been developed by H. A. Dodge for sizing relief valves for high temperature hot water-to-steam converters and is the Data Sheet this month. You will find it on page 141 which is perforated and ready to be removed for your daily use.

The use of air-to-air heat pumps in a large nuclear research laboratory in California was decided after considering the many factors involved. Irwin Krane explains what was done and why in his article on page 143. Flexibility of the occupied space was one of the main requirements, and to accomplish this, heat pumps were installed on the roof to serve a total of 79 separate zones. Special filtering and fan systems had to be provided to solve the radioactive exhaust problems. After several months of operation, the design and installation of these systems have been proven as meeting all expectations.

How to balance and test air handling systems to assure satisfactory performance is discussed by three engineers in the article on page 146. James Bricker maintains that one of the final responsibilities of the consulting engineer on an air conditioning project is supervision and testing of the major system components and the duct system. K. E. Robinson discusses the evaluation of industrial exhaust system performance, and he explains how this is done based upon his experiences. Continuous, good air volume control is the key to keeping the ventilation system in a plant operating properly, according to R. J. Walker. This subject was discussed by these three engineers at the recent meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers in Chicago, and this article has been prepared from our notes made while attending the meeting.

You will find solar irradiation tables that will be of direct help to you in the article on pages 150 to 153 by Professor F. W. Hutchinson and M. O. Cotter. These tables contain all-year irradiation data for surfaces which are inclined toward the sun. This information should be of real value in accurately determining the solar load for sloping walls that are often used in the design of anti-reflection windows for commercial buildings. This article deals with surfaces which face south and which are inclined either 15 or 30 degrees forward. Two more articles will be presented in future issues in which tables for east or west facing forward inclined surfaces and for those facing southeast and southwest will be included.

Many interesting comments from readers are presented in the "Open for Discussion" pages from 95 to 106 this month.

Two more answers to the question about modulating No. 6 fuel oil are presented this month on pages 110 and 112 which have been received by two readers. We are always pleased to have your comments, questions, and suggestions.

I'm sure you'll also want to know about the many short items of interest and news on pages 51 to 54 as you move on through this issue.

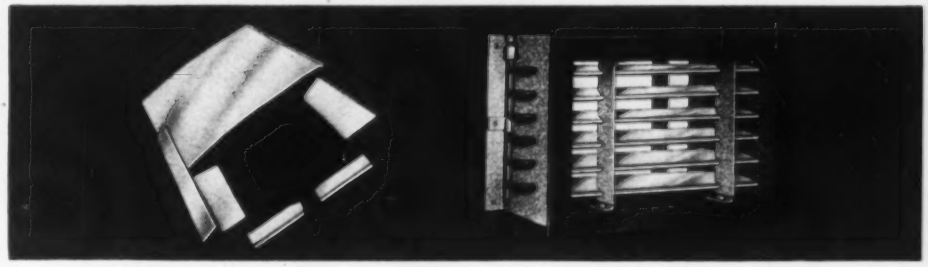
Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

NOW... IN AIR DISTRIBUTION
CONNOR MAKES THE *COMPLETE* CONTRIBUTION

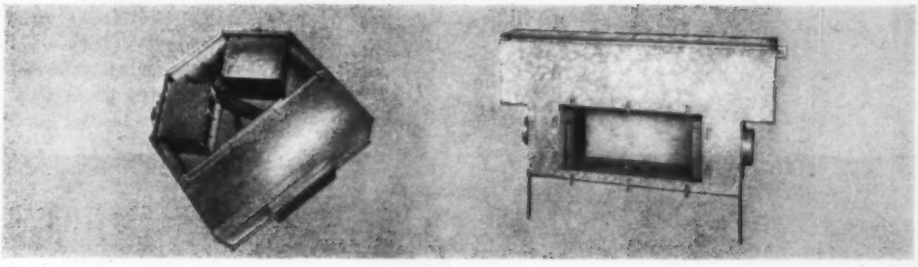
low – medium – high velocity air valves

PNEUMAVALVE—a contribution made only by Connor—adapts with equal facility anywhere that air must be controlled. Needs neither mechanical linkage nor operators. Response is instantaneous, positive, linear. No hysteresis. Minimum turbulence. A range of sizes. Bulletin K-45.



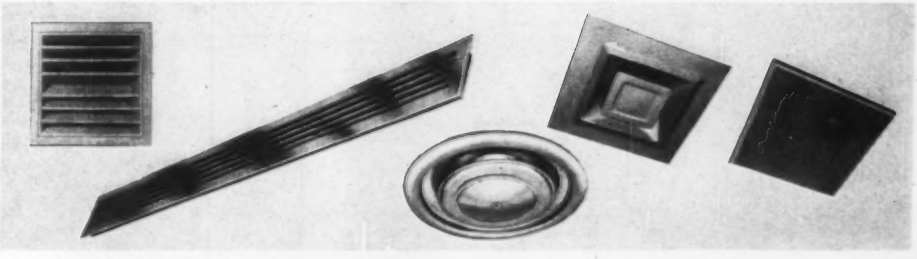
high velocity valve attenuators

At the heart of every model in Connor's Series 45P line is PNEUMAVALVE, the exclusive element that makes this Series superior for fault-free, ultra-quiet, minimum-maintenance performance. Shown are the DPC total constant volume Ceiling unit, left, and the unique DPW total constant volume Under-Window Sill-Slot unit. Bulletins K-33A, K-46, K-52, 31F.



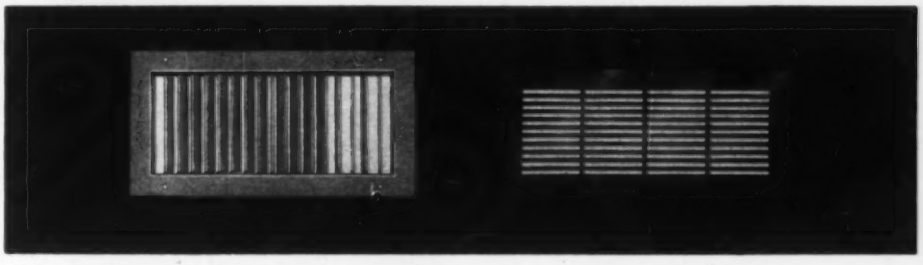
air diffusers

Shown are representative models in the complete Kno-Draft air diffuser line . . . adjustable and fixed pattern. Smart, simple styling that blends perfectly, unobtrusively with any interior, most recent additions are the KSS multi-pattern diffuser, extreme left, and the KO perforated diffuser, extreme right. Bulletins K-20A, K-27A.



grilles and registers

The extensive Kno-Draft line of grilles and registers offers a wide variety of face designs and rectangular configurations. Units that permit two-directional air flow, positive air volume control, other desirable features are available. Bulletin K-40.



CONNOR

DANBURY • CONNECTICUT

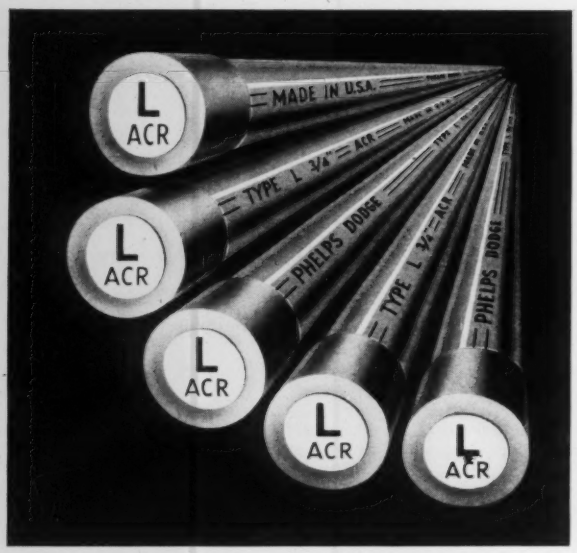
CONNOR kno·draft® AIR DIFFUSERS

WHY YOU SHOULD SPECIFY

Phelps Dodge Copper Refrigeration Tube

The Famous Mine-to-Market Quality Line!

1 FINEST QUALITY CONTROL. Phelps Dodge refrigeration tube is carefully controlled for quality throughout fabrication, rigorously tested before being packaged to assure finest tube properties and lasting quality in service.



2 COLOR-CODED ACR TUBE. Phelps Dodge ACR tube is specially cleaned for refrigeration use. Extra-long coded end caps are your assurance of factory-clean tube at job site. Tube is color coded "ACR" for your protection.

3 NEW P-D PAK CARTON. Reel-type design of convenient new carton allows tube to be rolled or paid out quickly on job. Color-coded identification tape seals carton for protection, makes opening easy.

Quality tube sold the quality way—through authorized refrigeration wholesalers!

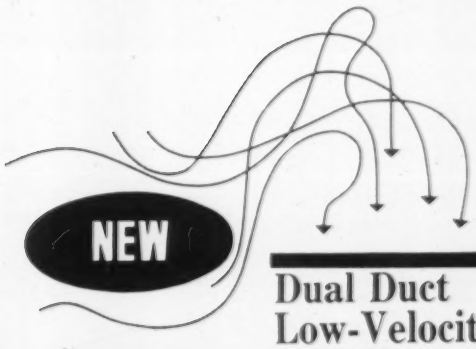
AIR-CONDITIONING AND REFRIGERATION WHOLESALERS
ASSOCIATE MEMBER

PHELPS DODGE COPPER PRODUCTS
CORPORATION
New York, N.Y. • Los Angeles, Calif.

P D

Carnes is first to offer engineers and contractors a completely packaged low-velocity control unit specifically designed to meet the requirements of dual duct low-velocity systems. Carnes Low-Velocity ATC Units . . . where limited space does not demand the smaller duct size of high-velocity systems . . . offer all the advantages of individual room control inherent in dual duct air distribution systems. 2 ATC Ceiling Models — end discharge and bottom discharge in 5 sizes. 2 ATC Window/Perimeter Models — front and top discharge in 2 sizes.

LEADERS GO TO CARNES FOR THE NEWEST IN AIR DISTRIBUTION



NEW

NEW

NEW

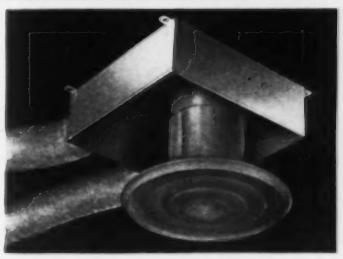
NEW

NEW

NEW

CARNES

Dual Duct Low-Velocity ATC Units



NOW DUAL DUCT COMFORT AT LOW-VELOCITY COST

Carnes Low-Velocity Acoustic Terminal Control Units — ATC — provide "pinpoint" temperature control for specific zones through the flexibility of dual duct air distribution without the need for sealed ducts, high pressure fans and high fan horsepower. Carnes Low-Velocity ATC Units proportion the hot and cold air in response to individual room thermostats . . . blend the hot and cold air for discharge to individual space areas . . . attenuate self-generated noise plus duct-carried noise . . . provide manual volume adjustment.

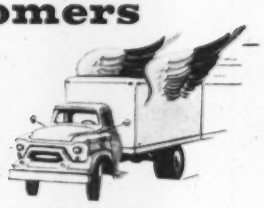
For complete information, write for Carnes Low-Velocity ATC Catalog 1361.

Carnes also manufactures: High-Velocity ATC Units • Modular, Round, Rectangular, Square, Convertible and Baseboard Diffusers • Registers • Grilles • Roof and Wall Ventilators.

CARNES CORPORATION, VERONA, WISCONSIN, / CANADIAN SUBSIDIARY: WEHR AIR EQUIPMENT COMPANY, LTD., 86 GERTIE STREET, WINNIPEG 2, CANADA

WATERLOO

makes a three count pledge to customers



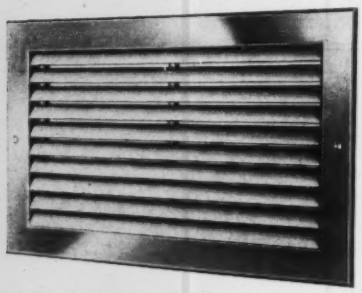
•You can be sure of getting fast service on any of Waterloo's wide range line of grilles and registers. Though we'll meet your requirements in a hurry, quality will never suffer.

•You can be certain that every Waterloo unit is easy to install. Each one is designed to assure the utmost in performance.

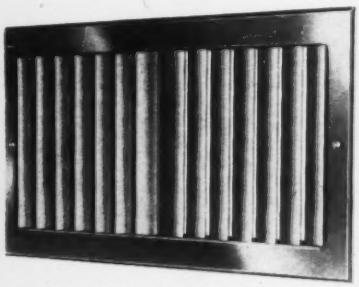
•You can count on the fact that Waterloo prices are competitive.

WATERLOO offers a complete line

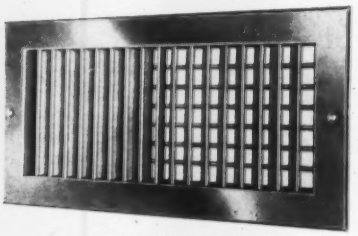
TYPICAL WATERLOO UNITS:



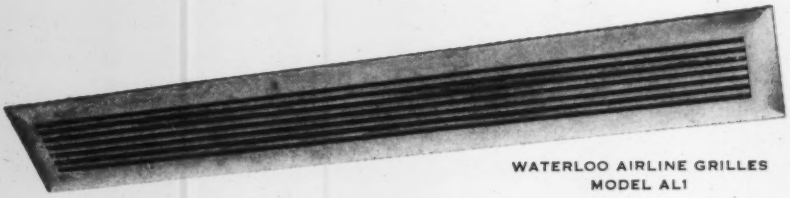
WATERLOO RETURN AIR GRILLES
AND REGISTERS
MODEL 3HD



WATERLOO CURVED LOUVER GRILLES
MODEL 1CV2



WATERLOO SUPPLY GRILLES
MODEL 2V



WATERLOO AIRLINE GRILLES
MODEL AL1

WATERLOO
Air Diffusion
EQUIPMENT

WR 121

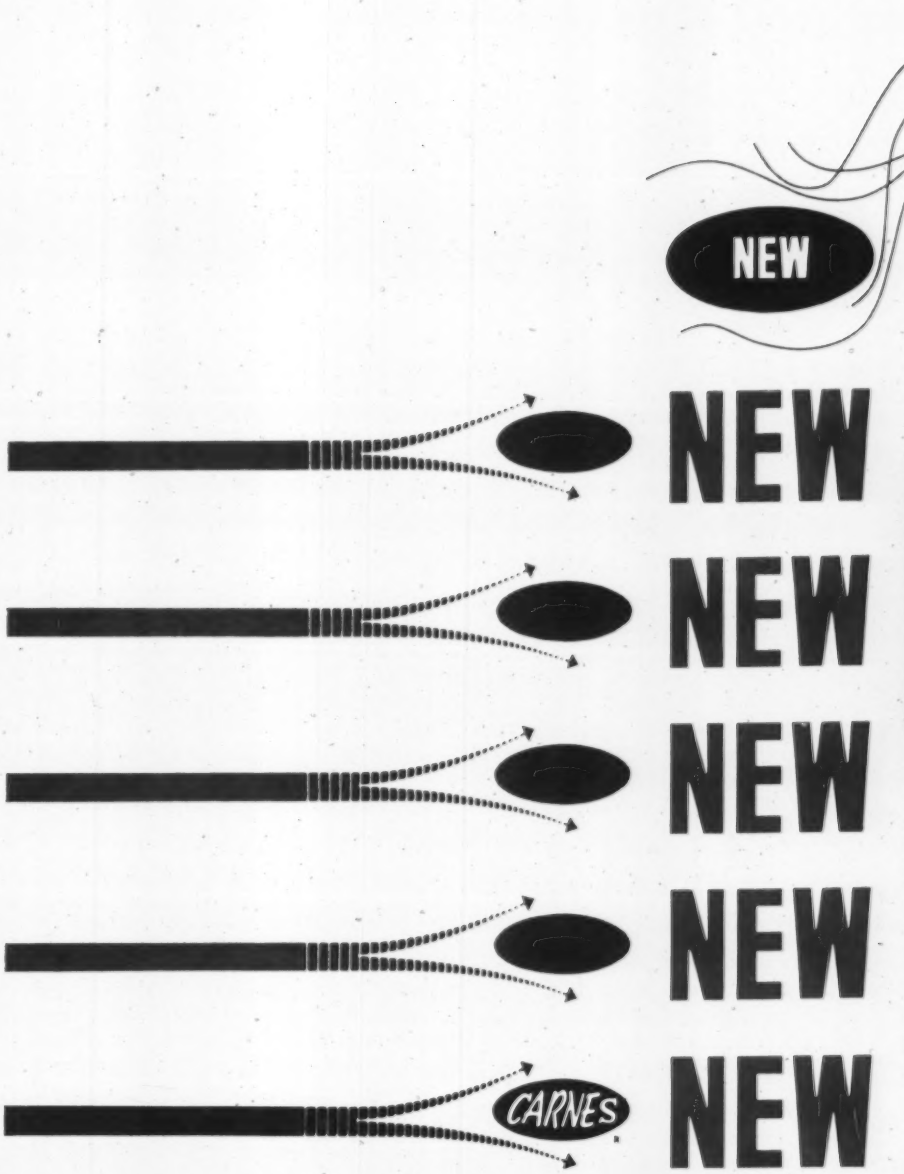
WRITE FOR COMPREHENSIVE WATERLOO CATALOG

WATERLOO REGISTER COMPANY, INC.

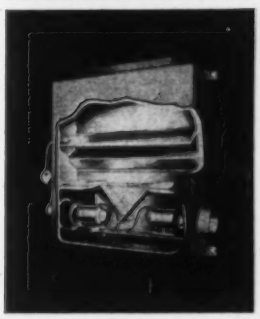
P. O. BOX 147, WATERLOO, IOWA

Carnes engineers lick high-velocity split service problems with new simplified all-pneumatic constant volume control. Only Carnes new Acoustic Terminal Control Units offer all these features: positive temperature mixing with integral blender; full acoustic baffling; inch-thick acoustic lining; metal protection on leading edges of lining; flow path not obstructed by perforated material; accurate pressure-drop sensing tips; non-stick, leak-free resilient valve seats. 3 ATC ceiling models — end discharge . . . bottom discharge . . . multi discharge. 2 ATC window/perimeter models — front discharge . . . top discharge. All models are available in single or dual duct with full control selection.

LEADERS GO TO CARNES FOR THE NEWEST IN AIR DISTRIBUTION



High-Velocity All-Air ATC Units



Carnes Acoustic Terminal Control Units feature new simplified all-pneumatic constant volume control with direct valve to motor connections, eliminating troublesome mechanical devices such as curtains, flappers, bladders, linkages. Carnes new ATC Units assure trouble-free lifetime operation. Investigate now. Write for ATC Catalog No. 1160.

Carnes also manufactures: Low-Velocity ATC Units • Modular, Round, Rectangular, Square, Convertible and Baseboard Diffusers • Registers • Grilles • Roof and Wall Ventilators.

CARNES CORPORATION, VERONA, WISCONSIN, / CANADIAN SUBSIDIARY: WEHR AIR EQUIPMENT COMPANY, LTD., 86 GERTIE STREET, WINNIPEG 2, CANADA

CENTURY MOTORS PULL HEAT OUT OF 42-STORY BUILDING

Forty-two stories above Dallas, on top of the South's tallest building, three Century 50 horsepower motors are driving induced draft fans to keep the Southland Center cool.

Heat absorbed by air conditioning and refrigeration systems must be returned to the atmosphere as efficiently as possible. Increasing industrial, commercial and domestic water consumption makes it necessary to use systems which recirculate and conserve the cooling water. This cooling tower is part of such a system.

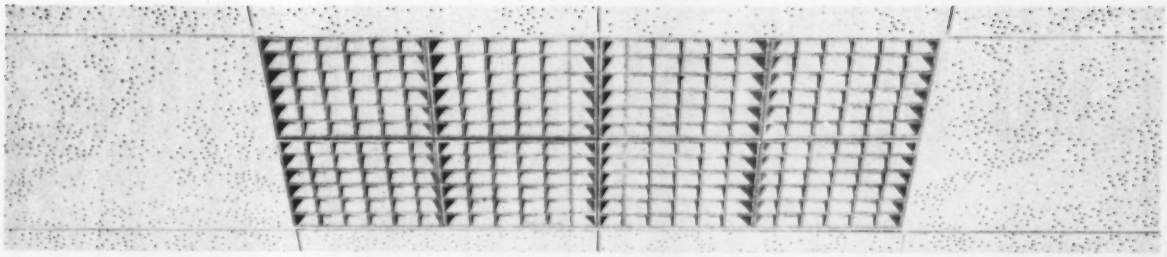
Continuous driving of three huge multi-blade fans is necessary to the operation of this three-cell tower. The Century motors are subject to all sorts of weather—heat, moisture, rain, wind, corrosion. But they keep working—continuously. Century application engineers understand such requirements—call your Century District Office or Authorized Distributor.

CENTURY ELECTRIC COMPANY

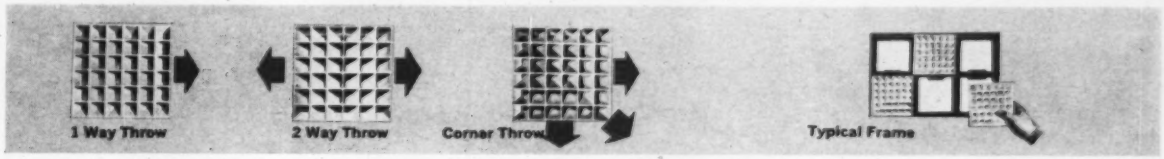
St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

59-23



LEADERS GO TO CARNES FOR THE NEWEST IN AIR DISTRIBUTION

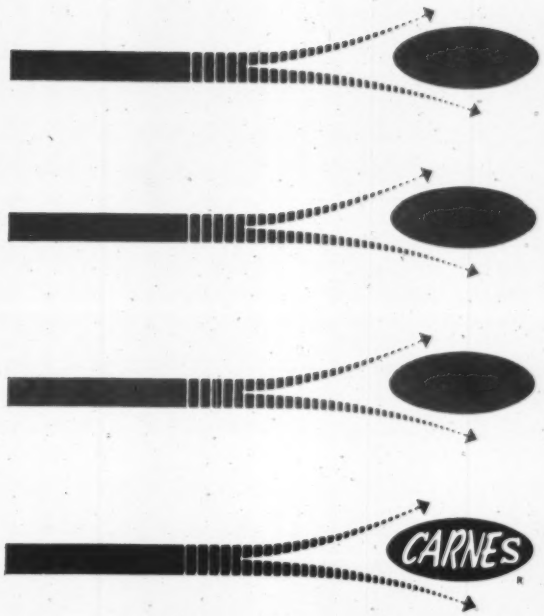


NEW

Modular Diffuser patent applied for

FUNCTIONAL! VERSATILE! UNOBTRUSIVE!

Carnes attractive white Model "M" Modular Diffuser enhances the aesthetic quality of any ceiling. The 6-inch square modules fit virtually flush with ceiling . . . have a minimum of see-through . . . inhibit smudging . . . easily slip in or out for changing air direction or cleaning. An infinite number of patterns and sizes are yours by combining multiples of three modules: 1 way throw, 2 way throw, corner throw. Continuous strip patterns . . . cross patterns . . . alternating patterns may be developed to solve any design or air distribution problem. Module units . . . above windows . . . between fluorescent fixtures . . . around columns or walls . . . butted to light fixtures . . . carry out architectural lines and blend with all ceiling materials. They are equally effective when used as an air return. Modules are made from General Electric's revolutionary new LEXAN, a self-extinguishing, high-impact material that withstands temperatures to 225° without distortion. Frames are available in a wide variety of sizes and types . . . easily joined to make any continuous length or width desired. For complete details, write for Modular Diffuser Catalog No. 460.



NEW

NEW

NEW

NEW

Carnes also manufactures Round, Rectangular, Square, Convertible and Baseboard Diffusers • Registers • Grilles • High- and Low-Velocity ATC Units • Roof and Wall Ventilators

CARNES CORPORATION, VERONA, WISCONSIN, / CANADIAN SUBSIDIARY: WEHR AIR EQUIPMENT COMPANY, LTD., 86 GERTIE STREET, WINNIPEG 2, CANADA

DUNHAM-BUSH ANNOUNCES FOR HEATING AND

NEW SALES POLICY HELPS

CONSULTING ENGINEERS
ARCHITECTS
CONTRACTORS

WITH INSTANT SUPPLY

NOW... Hot Water Specialties.....

FROM RECOGNIZED WHOLESALERS ONLY

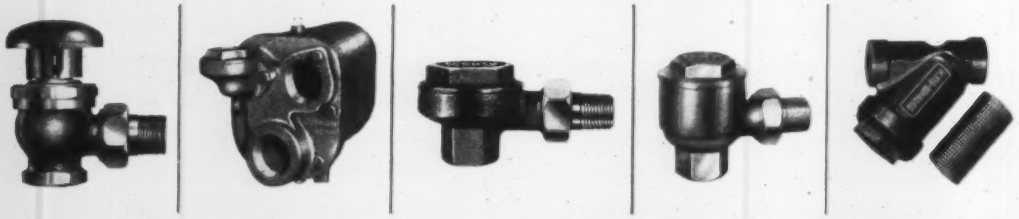
IMPORTANT MAIL FOR V.I.P.'s

Recently, wholesalers received several important communications from Dunham-Bush announcing a drastic change in distribution policies. Effective February 1, 1961, all orders for hot water specialties, A-5 and A-9 centrifugal pumps and four and six inch converters **must** go through recognized heating, air conditioning and refrigeration wholesalers.

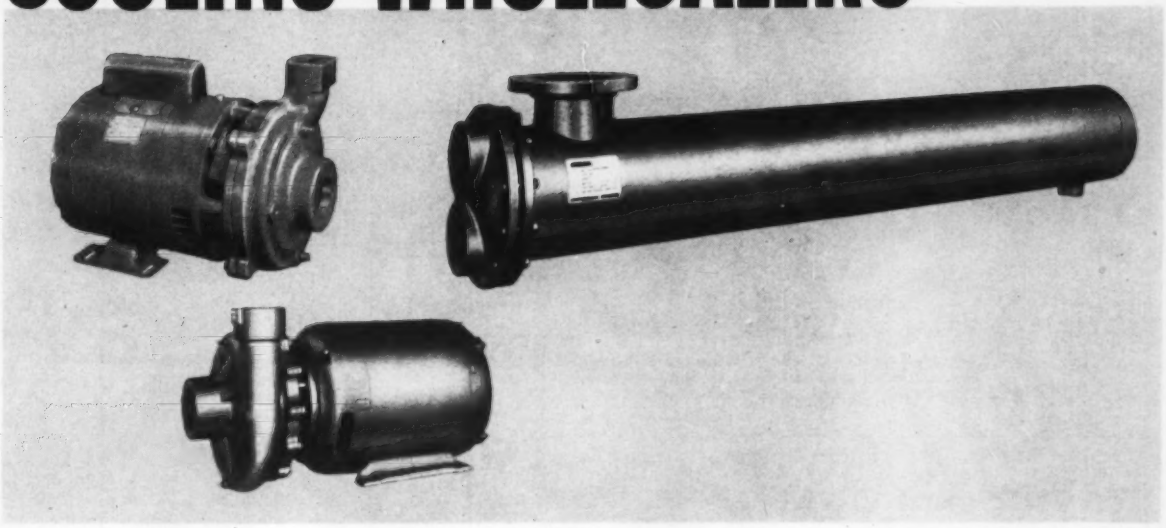
Dunham-Bush, is shooting the works to make this new policy profitably successful in your, the wholesalers', behalf. The complete package has been sent to you including price lists, discount information, etc.

At last a major brand, long-line manufacturer has teamed up with wholesalers and the response has been tremendous. Your analysis of Dunham-Bush wholesale policy mailings will demonstrate that here are highest quality brass goods at lower prices; pumps with ratings and performance that can't be matched; stellar performing steam converters backed by over 50 years of Dunham-Bush heat transfer experience.

IF you haven't acted yet, **IF** these mailings have missed your desk, then by all means contact Department HP, Dunham-Bush, Inc., 179 South Street, West Hartford, Conn.



INSIDE-TRACK PROFIT POLICY
COOLING WHOLESALERS



. . . Centrifugal Pumps . . . Steam Converters

FROM RECOGNIZED WHOLESALERS ONLY

AND MORE "SALES-SOCK" STOCKING OPPORTUNITIES

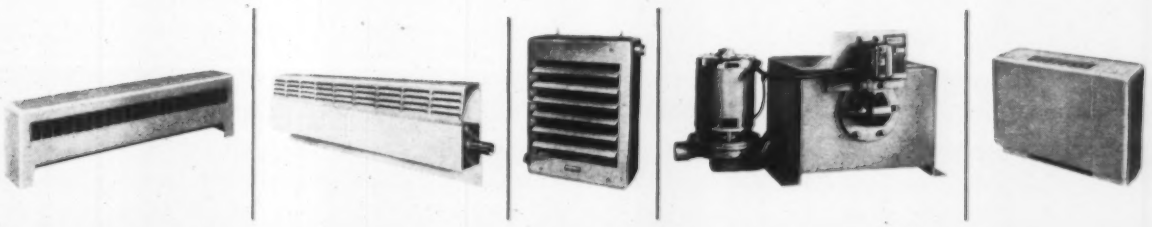
Heating and refrigeration wholesalers may also selectively stock other "one source—one responsibility" Dunham-Bush products. These include: steam specialties, unit heaters, condensate pumps, radiation, baseboard, cooling/heating units, etc. All are choice wholesaler items.

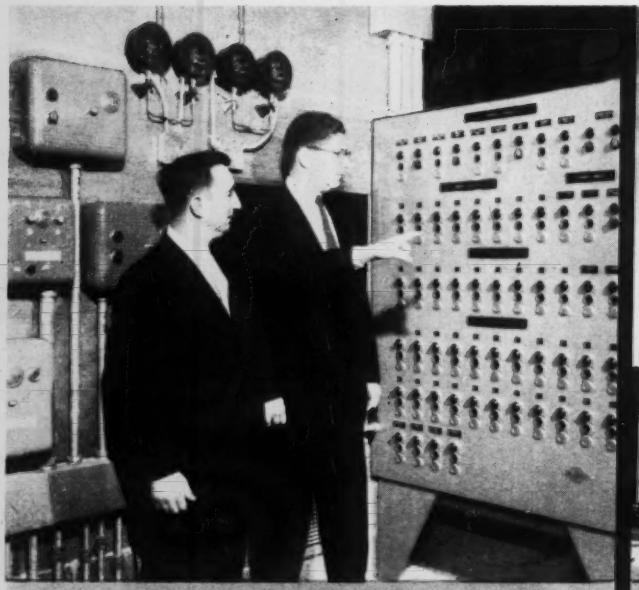
DUNHAM-BUSH

DUNHAM-BUSH, INC.

WEST HARTFORD 10, CONNECTICUT, U. S. A.

SALES OFFICES LOCATED IN PRINCIPAL CITIES





Centralized control for all of the 59 heating and cooling units throughout the building is provided by this Arrow-Hart Master Push Button Panel. Consulting engineers Arthur Bigelson and S. M. Shefferman look it over.

BENDER BUILDING, Washington, D. C. Builder: Blake Construction Co.
Consulting Engineers: Shefferman and Bigelson.
Mechanical Contractor: Frank Blanch, Sr.
Electrical Contractor: Walter Truland Co., Inc.

SERVICE and QUALITY determine selection of ARROW-HART Motor Controls for Bender Building

ARROW-HART MOTOR CONTROLS used in the ultra-modern Bender Building, largest new office building in Washington, D. C. include across-the-line, reduced voltage starters, and push button controls for the heating, ventilating and air-conditioning motors. Centralized master panels operate all magnetic starters and controls for restaurant equipment and other special facilities.

ARROW-HART FIELD ENGINEERING SERVICE played an important part in assuring prompt, trouble-free installation of hundreds of individual motor control units by the electrical contractor. Working in close cooperation with the mechanical contractor, the temperature control supplier and the consulting engineers, Arrow-Hart's Field Representative coordinated all ordering information. The centralized control panels were pre-engineered for specific installation requirements.

Write for more information on Arrow-Hart Motor Controls and Service to The Arrow-Hart & Hegeman Electric Company, Dept. HPAC, 103 Hawthorn St., Hartford 6, Connecticut.

All restaurant electrical equipment, including fans, compressors, pumps, etc., is controlled by this master push button panel custom-engineered by Arrow-Hart

CONSULTING ENGINEER:
S. M. Shefferman of Shefferman and Bigelson . . . "Arrow-Hart met the rigid specifications that we demanded in the construction of this building."

MECHANICAL CONTRACTOR:
Frank Blanch, Sr. . . . "Arrow-Hart's Master Push Button Control Panel that provides centralized control should certainly save money in the operation of the 59 heating and air conditioning units."

BUILDING SUPERINTENDENT:
Robert McDaniel . . . "Arrow-Hart supplies good, durable equipment that does the job expected of it."

ARROW AH HART

Quality since 1890

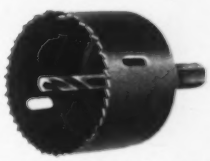
MOTOR CONTROLS • ENCLOSED SWITCHES • APPLIANCE SWITCHES • WIRING DEVICES

Skil ball-bearing drills at these prices?

At only $32.50, the New **Skil Model 70** (*top*) stretches your dollars further than any industrial ¼-incher you can buy! Yet it's every inch a quality Skil tool, with ball-bearing construction; powerful 2.5 amp motor; precision helical gears; tough, lightweight aluminum housing.

New **Skil Model 76** (*bottom*) is today's answer for buyers who want a broad-shouldered, ⅜-inch drill—low in price ($42.50)—but high in quality. Has ball bearing construction, lightweight aluminum housing. Auxiliary side handle gives better control, extra leverage when using hole saws and large bits.

See your Skil distributor for a demonstration. Look under "Tools-Electric" in the Yellow Pages. Or write: Skil Corporation, Dept. 134D, 5033 Elston Avenue, Chicago 30, Illinois.



Drill holes up to 1½" dia. with Models 70 & 76 and fast cutting Skil Hole Saws. Other hole saws up to 3¼" dia. available.

SKIL ... and SKILSAW POWER TOOLS

FOR AIR CONDITIONING . . .

Get exact water control through

Exclusive Honeywell design makes the difference in pneumatic valves!

✓ CHECK THESE HONEYWELL DIFFERENCES:

THE ACTUATOR

1 **Rolling-type diaphragm** assures constant effective area throughout stroke, provides maximum power when needed.

2 **Snap-seal** bead on diaphragm. The higher the pressure, the tighter the seal.

3 **Bullseye stem button design** maintains smooth stem travel, eliminates side thrust, assures positive positioning.

THE VALVE

4 **Specifically designed** to modulate hot and cold water in sequence.

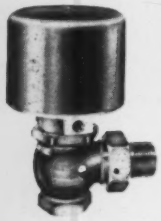
5 **Two contoured plugs** insure equal percentage output for either hot or cold flow.

6 **Body is a brass forging** and all internal parts are brass or stainless steel with rubber seals.

7 **Spring-loaded, self-adjusting** rubber packing rings eliminate field packing adjustments.

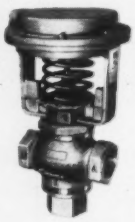
The Honeywell VP522A is the only modulating sequencing valve specifically designed to control the flow of both hot and cold water to fan-coil and induction units. This three-way, pneumatically-operated valve assures maximum power when you need it most—when the valve is approaching the closed position. The flexible, rolling-type diaphragm keeps the effective area of the actuator constant, regardless of the position of the diaphragm itself. Bullseye action by the stem retainer and contoured plug prevents side thrust, provides more sensitive, precise flow control.

The assembly is corrosion resistant. Molded-in composition discs assure tight shut-off. Two inlets and a common outlet are threaded for ½ inch, ⅝ inch and ⅞ inch OD flare fittings to cover the additional requirements of this valve. Only Honeywell offers this selection. And the actuator can be rotated 360° on the bonnet, permitting easy alignment with air piping from any direction. For full details, call your nearest Honeywell office. Or, write Honeywell, Dept. AC-4-79, Minneapolis 8, Minnesota. In Canada write Honeywell Controls, Limited, Toronto 17, Ontario.



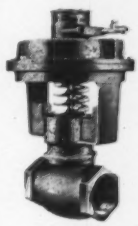
Pneumatic Radiator Valves
VP520A, VP520C

Direct-acting, normally open, single-seated valves in straight-through, straight-through offset or angle patterns. VP520A is modulating for two-pipe steam and hot water systems. VP520C is used with a 2-position controller on one-pipe steam systems.



Three-way Pneumatic Coil Valve
V5013A

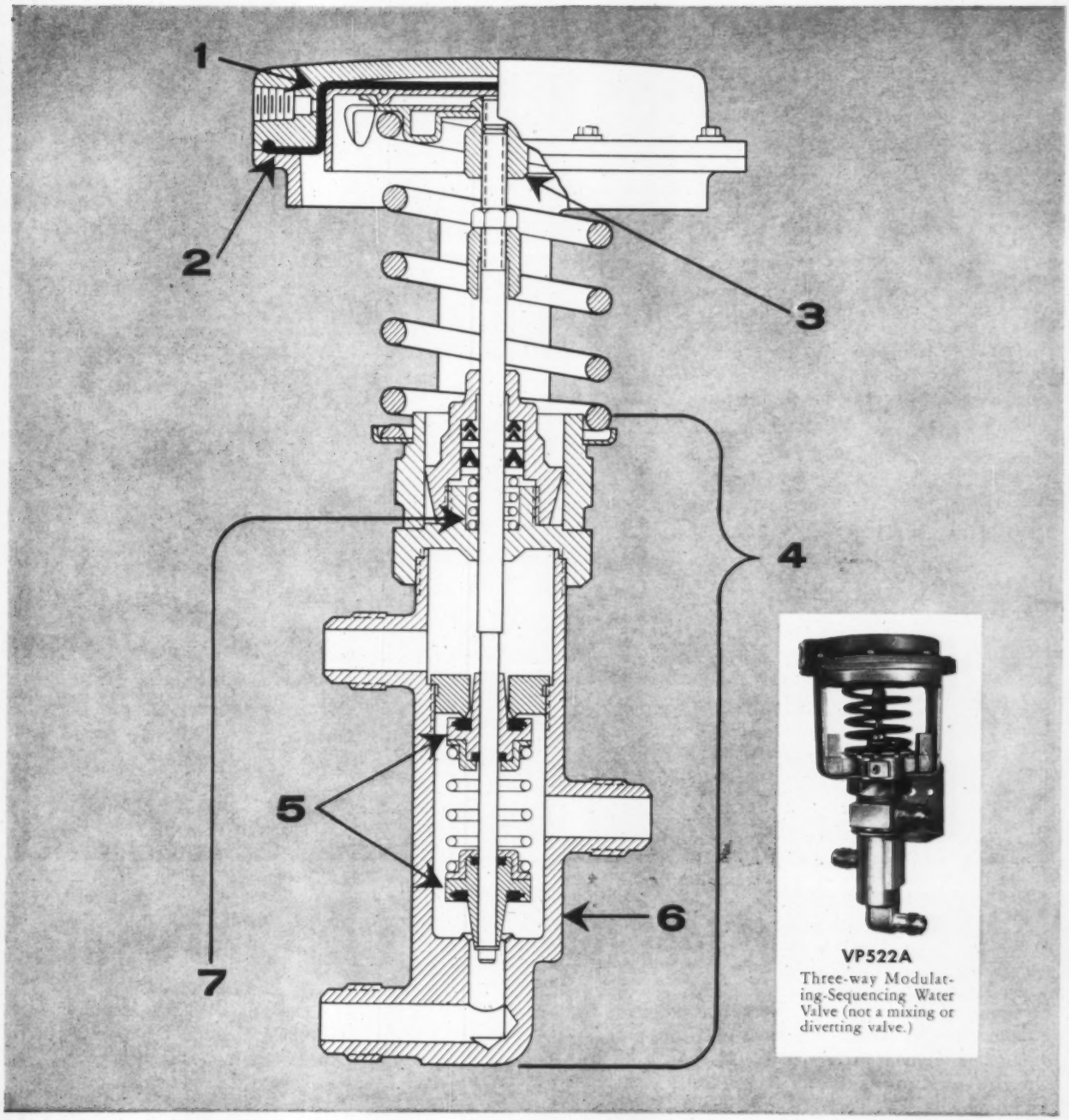
Can be used for mixing service to direct two inlets to a common outlet. Should not be used to divert flow from a common inlet to two outlets. For use with pneumatic, electric or electronic operators to form a motorized valve assembly for the control of hot or chilled water.



Single-Seated Valve Bodies
V5011A, V5011B

Straight-through, globe-type valves with cast-bronze screwed ends or cast-iron flanged ends. V5011A is direct-acting. V5011B is reverse-acting. Excellent flow control is achieved by using equal-percentage, high-lift, plug-type throttling guides.

"Constant Power" actuation



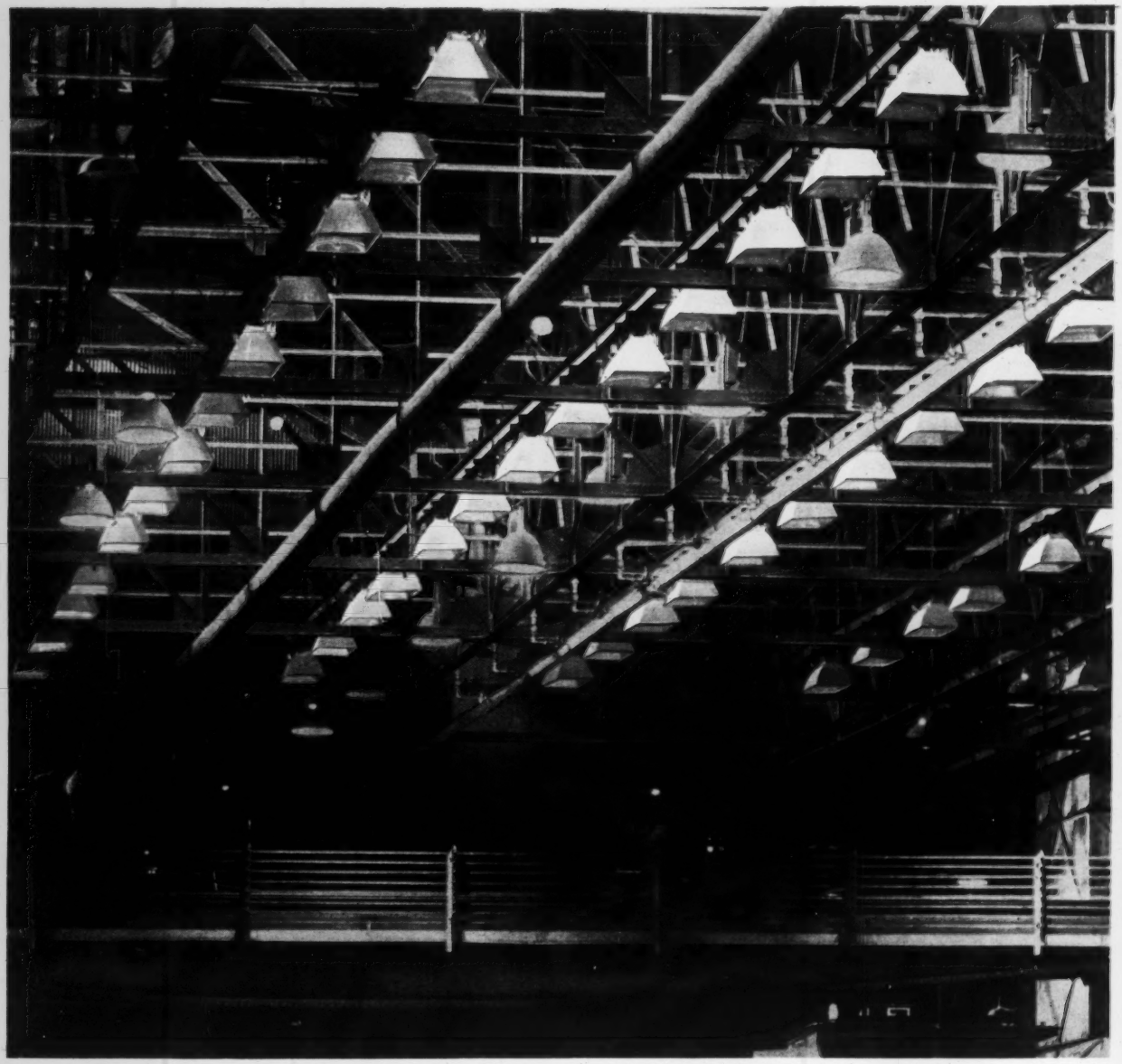
VP522A
Three-way Modulating-Sequencing Water Valve (not a mixing or diverting valve.)

Honeywell

First in Control

SINCE 1885

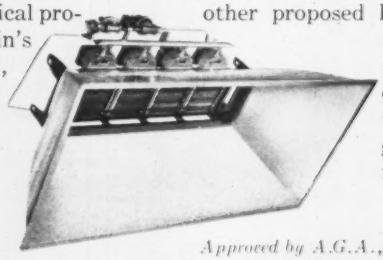
HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.



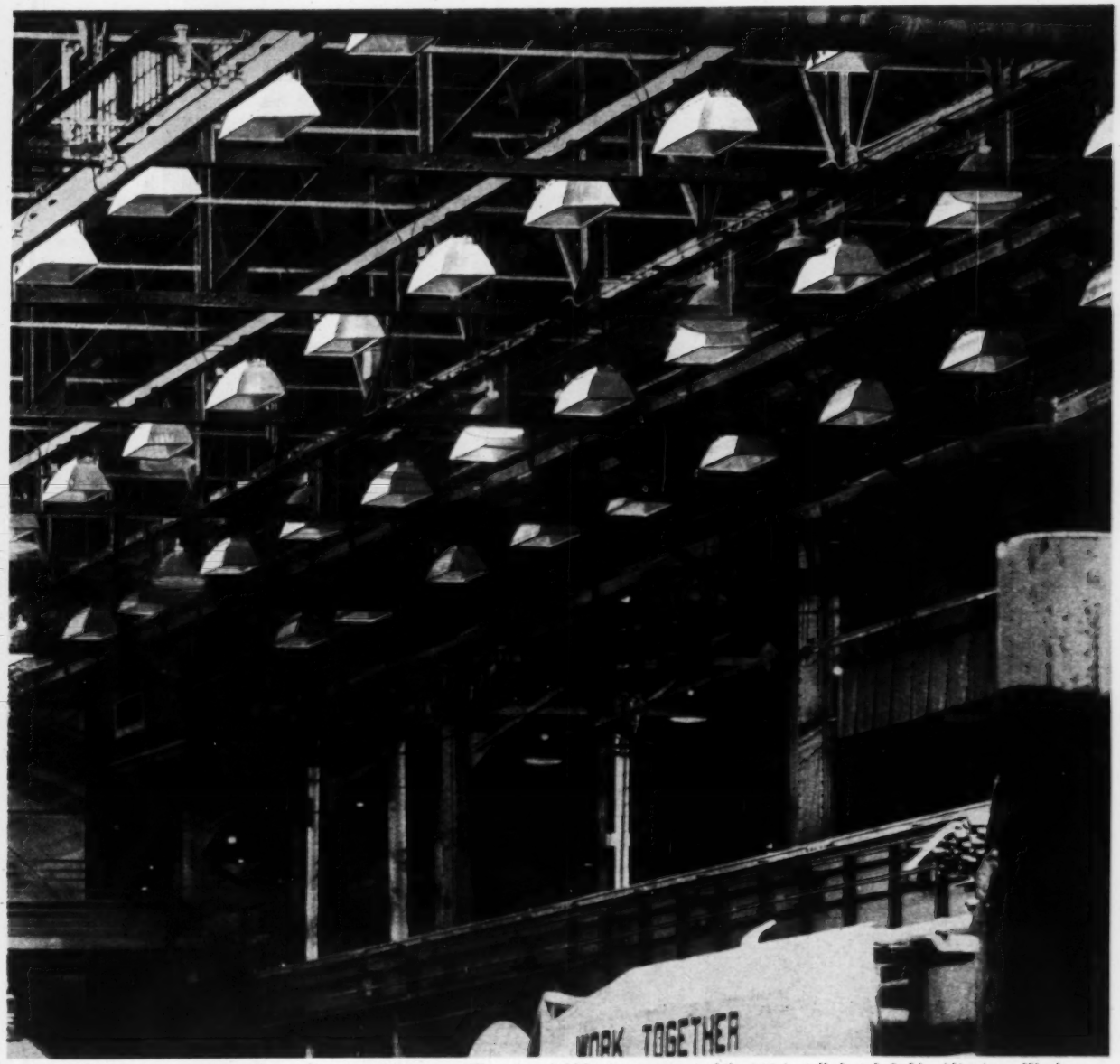
300 (48,000 BTU/H) Perfection Schwank Gas Infra-Red Heaters Mounted at a height of 36 ft., heat the area of 100 ft. wide by 500 ft.*

J & L Steel Saves 46% in BTU's with

Minimum 55° machinery temperature is necessary to guarantee peak operating efficiency of critical production equipment at Jones & Laughlin's No. 1 Continuous Weld Pipe Mill, Aliquippa, Pa. Replacing their previous heating equipment, 300 Perfection Schwank *Gas* Infra-Red Heaters (600 in the entire plant) meet this tough requirement with a BTU capacity 46% less than any other proposed heating system. Total maintenance requirements consist of air blowing the gas-fired units once each heating season. After three full seasons of dependable gas heat and employee comfort, not one of the 2,400 ceramic



Approved by A.G.A., Underwriters, C.G.A. and C.S.A.



long without partitions or walls to adjoining plant areas. These gas-fired heaters are part of the 600 installed at J & L's Aliquippa Works.

Perfection Schwank Gas Infra-Red Heaters

burners (4 per heater) has needed replacement.

Perfection Schwank *Gas* Infra-Red Heaters give J & L all the advantages of modern *gas* heat . . . high efficiency, precise control, speed, cleanliness, economy and dependability of supply. Gas can be the answer to your unusual or everyday heating problems.

Heat better for less with Perfection Schwank *Gas* Infra-Red Heaters. For complete information, contact your local Gas Company or write to Perfection Division of Hupp Corporation, licensee of American Infra-Red Radiant Co., 1135 Ivanhoe Road, Cleveland 10, Ohio. *American Gas Association*

*Under Schwank U.S. Patents 2,775,294 and 2,870,830 and pending applications.

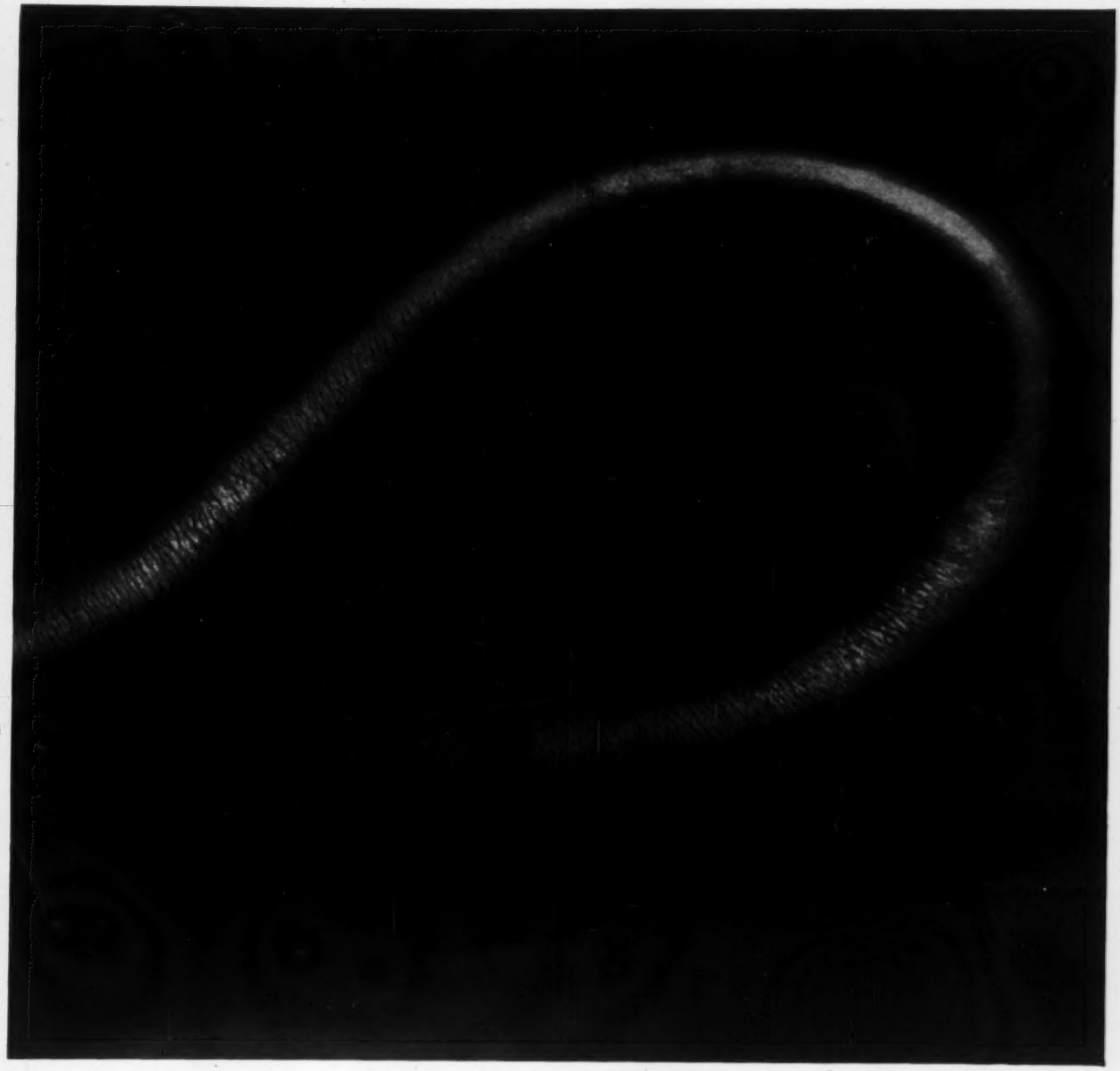
FOR HEATING GAS IS GOOD BUSINESS!

Stop pipe condensation with the built-in vapor barrier of J-M Aerotube

... THE FLEXIBLE, FOAMED PLASTIC PIPE INSULATION THAT CUTS INSTALLATION COSTS IN HALF.

For heating, plumbing and air-conditioning service—wherever sweating or condensation is a problem—Johns-Manville Aerotube® is the economical solution.

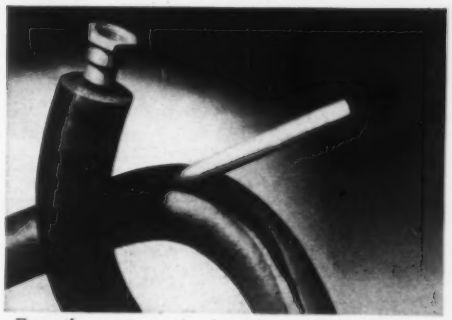
Aerotube is a tubular pipe insulation for use at temperatures from 32F to 220F (double layer of Aerotube permits range of 0F to 220F). Its closed cell structure stops the passage of moisture. This built-in vapor barrier, plus the insulating effectiveness of Aerotube, will prevent condensation under normal design conditions on indoor lines. What's more, you



can depend upon Aerotube to maintain its effectiveness indefinitely.

Aerotube is the easiest-to-install pipe insulation available today. On a straight run of pipe or the most complex bend, Aerotube's six-foot lengths go on quickly. For connected pipe, just slit Aerotube longitudinally, snap it on, and seal it up! You'll discover that labor costs are substantially reduced when Aerotube is chosen to solve condensation problems.

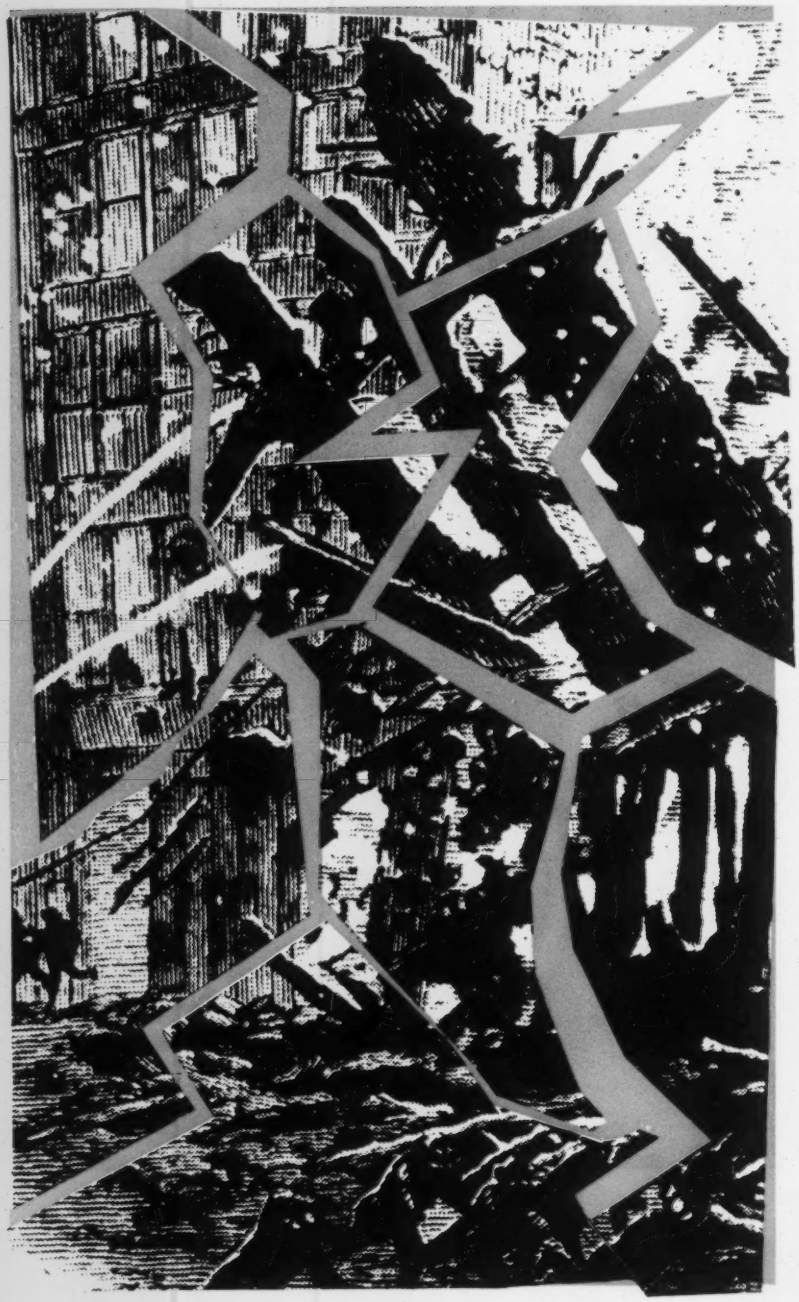
Available in a wide range of thicknesses, there's an Aerotube insulation that meets your particular needs. For full information, send for brochure IN-213A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.



Even the most complex bend is easy to insulate with flexible J-M Aerotube.

JOHNS-MANVILLE

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE



On April 18, 1906
when the great
quake hit
San Francisco,
Hussey had a
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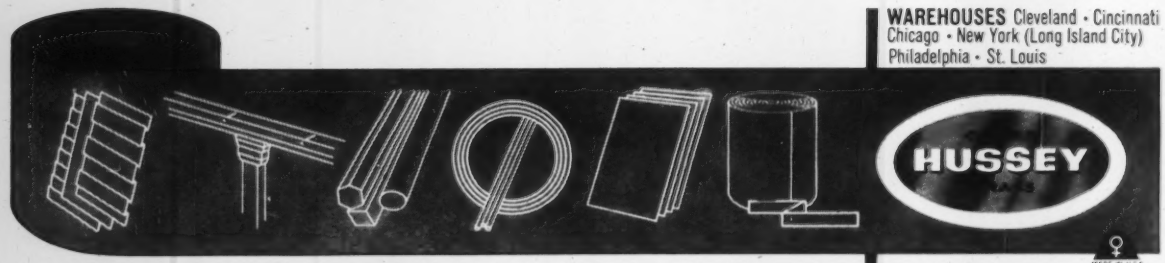
for quality
copper
for 58 years



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TO THE STANDARDS
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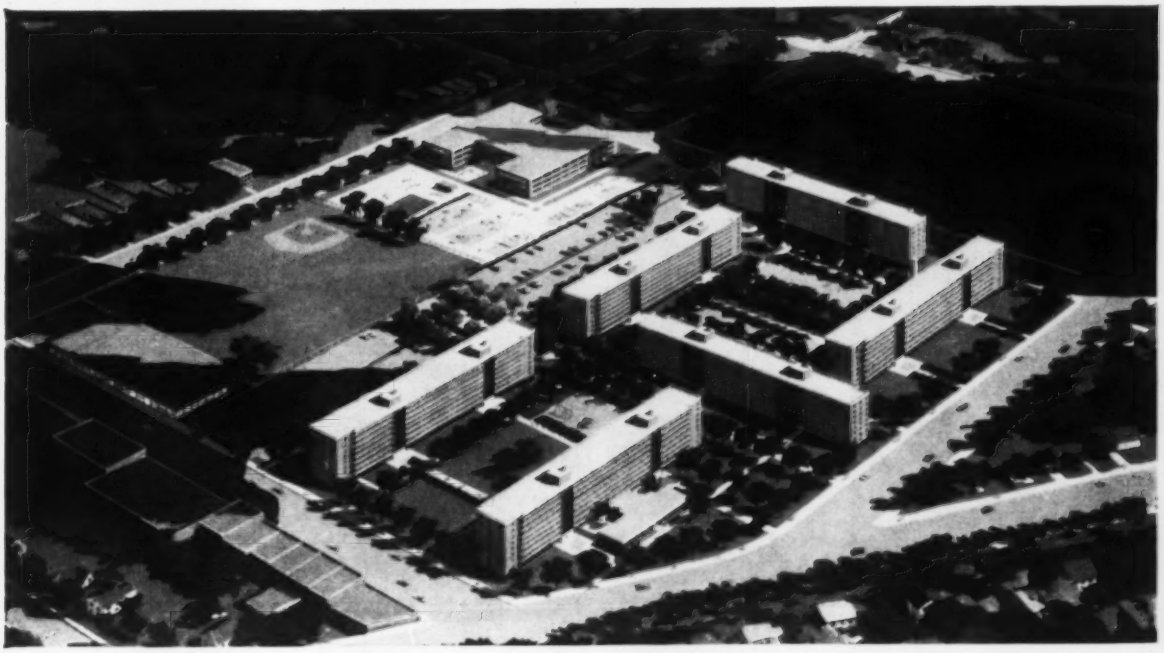
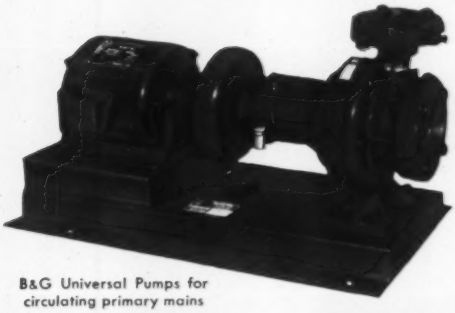


SPACE HEATING
...DOMESTIC WATER HEATING
...SNOW MELTING

ALL PROVIDED BY A B&G *Hydro-Flo* SYSTEM



B&G Universal Pumps for circulating primary mains

B&G Booster and PD Booster Pumps supply individual zones

B&G Monoflo Fitting

Stapleton Houses, Staten Island, N. Y.
Owner: The New York City Housing Authority
Architects: Ballard, Todd and Snibbe
Mechanical Engineers: Carlson & Sweatt
Mechanical Contractor: H. Sand & Co.

This example of contemporary mass housing employs *hydronic* heating at its versatile, economical best. Space heating, domestic water heating and snow melting are all effected by means of circulated hot water. *Primary and secondary pumping*, as conceived and developed by B&G engineers, makes possible this triple-function system.

Where multiple buildings or multiple zones are to be heated with circulated water, this pumping method materially reduces the pump horsepower required, improves heat control and saves fuel.

This installation is basically a two-zone primary distribution system with 3 secondary heating zones, 1 secondary domestic water zone and 1 secondary snow melting zone in each building. The space heating risers are of the B&G up-and-down Monoflo type, using 3,303 Monoflo Fittings.

Write for free booklet which gives detailed information on this more efficient, more economical method of heating with water.

BELL & GOSSETT
COMPANY

Dept. GP-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

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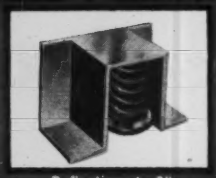
Deflections to 3"
Load Range 25# to 20,000#
Bulletin "A-10"

SERIES "U" MOUNTINGS



Deflections to 3"
Load Range 25# to 2500#
Bulletin "U-10"

SERIES "C" MOUNTINGS

Deflections to 3"
Load Range 25# to 2500#
Bulletins "C-10", CD 10

SERIES "P" MOUNTINGS

Deflections to 6"
Load Range 400# to 20,000#
Bulletin "P-10"

SERIES "J" MOUNTINGS

Deflections to 3"
Load Range 400# to 20,000#
Bulletin "J-10"

SERIES "R" MOUNTINGS

Deflections to ½"
Load Range 10# to 6000#
Bulletin R-11

INTEGRAL FAN BASES

Deflections to 3" with "A" or "C" Mounts, to ½" with "R" Mountings
Bulletins AB-10, AC-10 RB-10

SERIES RB AND

Deflections to ½"
Bulletin RB-10

SERIES RFP AND

Flexible Rubber Pipe
Bulletin RFP-10

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- ABSORPTION MACHINES
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- HEATING UNITS
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- PUMPS
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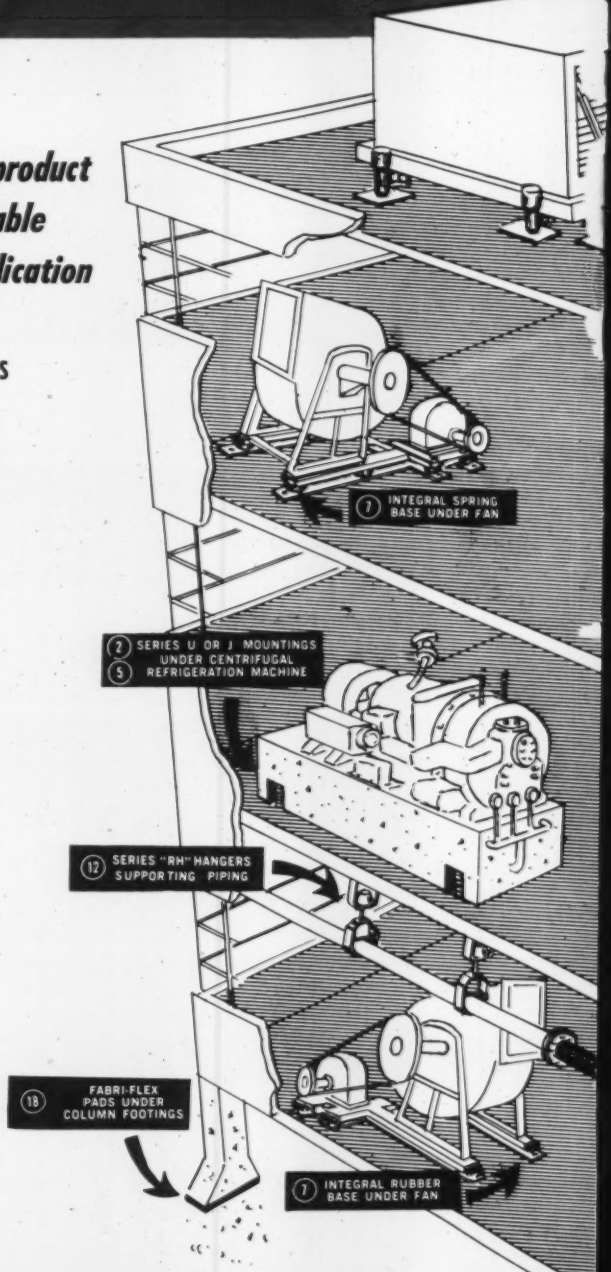
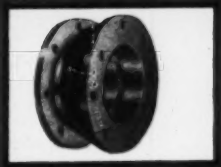
- VENT SETS


7 INTEGRAL SPRING BASE UNDER FAN
2 SERIES U OR J MOUNTINGS UNDER CENTRIFUGAL
5 REFRIGERATION MACHINE
12 SERIES "RH" HANGERS SUPPORTING PIPING
18 FABRI-FLEX PADS UNDER COLUMN FOOTINGS
7 INTEGRAL RUBBER BASE UNDER FAN

WRITE FOR FREE VIBRATION CONTROL DATA BOOK

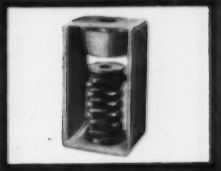
Flexible Metal Pipe
Bulletin MFP-10



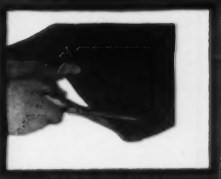
Rubber expansion joints
Bulletin RXJ-10

Deflections to ½"
Load Range 10# to 4000#
Bulletin RH-11

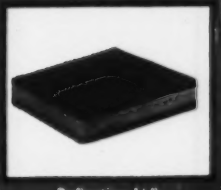
Deflections to 1¼"
Load Range to 2500#
Bulletin SH-10



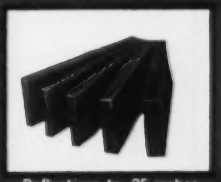
Deflections to 1½"
Load Range to 2500#
Bulletin RSH-10



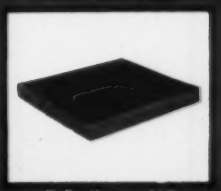
Deflection 1/16"
Load Range 25 to 100 PSI
Bulletin PT-11



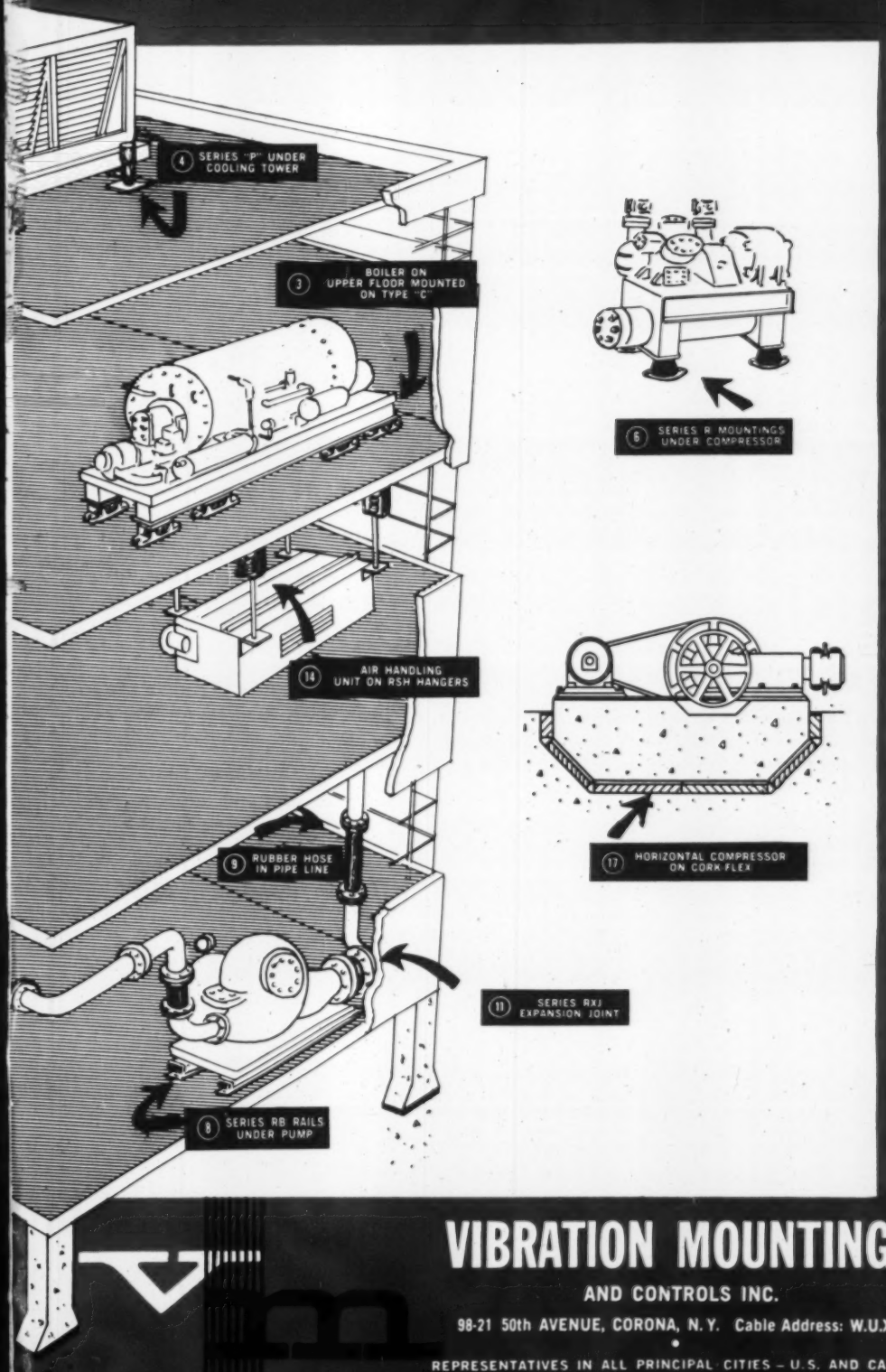
Deflection ⅛"
Load Range 25 to 60 PSI
Bulletin PT-20



Deflections to .25 inches
Load Range to 8500 PSF
Bulletin PT-30



Deflections to ⅛"
Load Range to 1500 PSI
Bulletin PT-40


4 SERIES "P" UNDER COOLING TOWER
3 BOILER ON UPPER FLOOR MOUNTED ON TYPE "C"
6 SERIES R MOUNTINGS UNDER COMPRESSOR
14 AIR HANDLING UNIT ON RSH HANGERS
17 HORIZONTAL COMPRESSOR ON CORK-FLEX
9 RUBBER HOSE IN PIPE LINE
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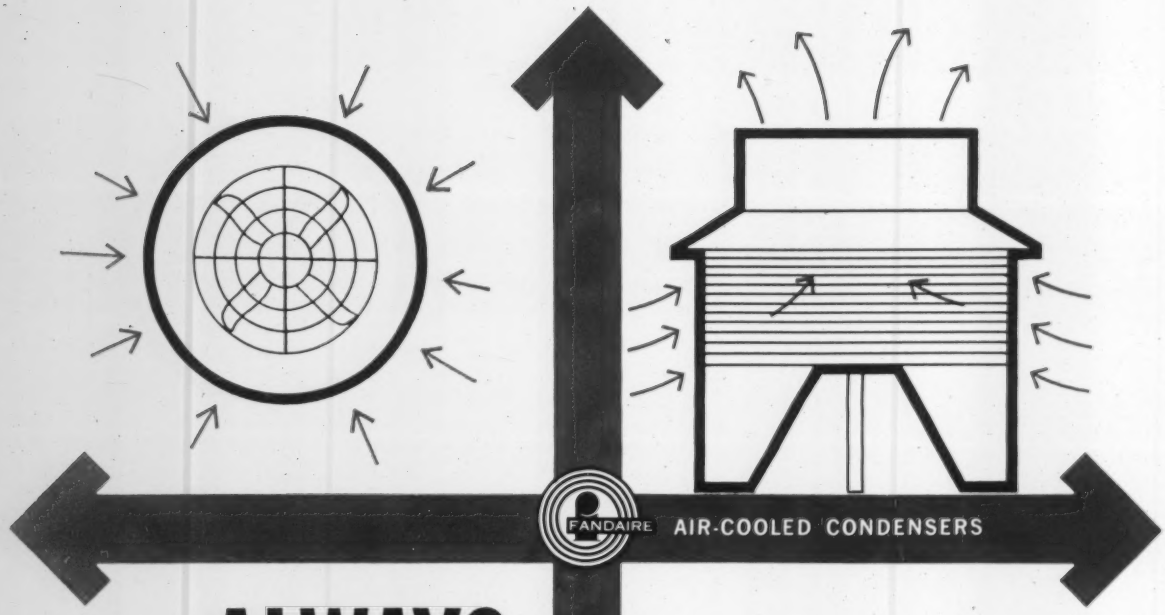

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REGARDLESS OF WIND DIRECTION

Fandaire's original circular design has basic exclusive features that are making this air-cooled condenser the new standard of the industry. There are good reasons why: this modern low silhouette condenser is engineered around the high heat-dissipating Yuba fintube. Every spiral is surrounded by swiftly moving cool air from every direction. Although Fandaire's heavier fin construction assures higher heat transfer efficiency, the entire unit weighs at least one-third less than ordinary condensers.

Fandaire's circular design eliminates return bends and allows a true counterflow arrangement – coolest gases meeting the coolest air. Cool air is drawn in from all sides, not off the hot roof . . . hot air is expelled up and out. The entire unit can be positioned where needed, without guy wires or extra bracing. Piping and installation savings can be considerable.

Built for industrial, commercial and home installation – from 3 to 120 tons, single or multiple units. Get full details today.

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specialists in circular air-cooled condensers and condensing units

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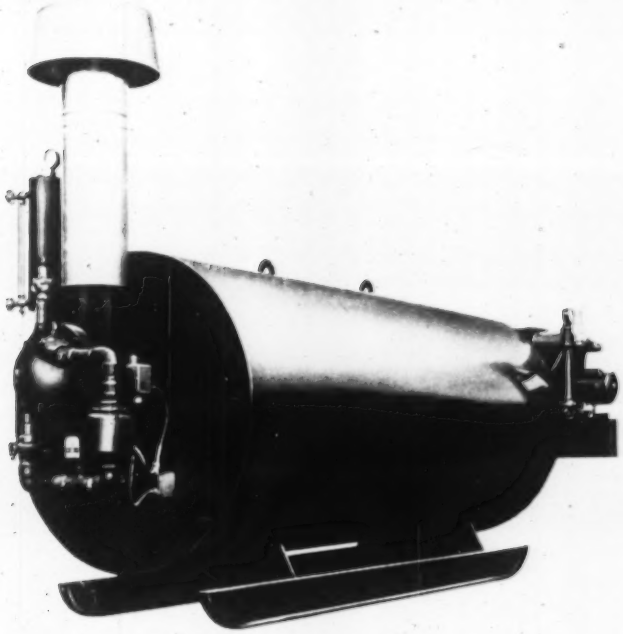


p-k scalefree 230*

first indirect gas fired storage water heater

provides lots of hot water...fast

for Hitchins, Ky., General Refractories Co. Plant

GENERAL REFRACTORIES COMPANY

A million-dollar expansion at the Hitchins, Ky., plant of the General Refractories Co. required a 40% increase in employees – and more hot water.

Following a survey of available heaters, the company decided on the SCALEFREE 230 because of its exclusive thermal design principle. The new heater employs three basic systems: the gas-burning system – the furnace part of the unit; a forced circulation transfer fluid system; and the service water system, which provides for storage, heating and temperature control. Since heat transfer occurs below the temperature at which the minerals that cause scaling precipitate, the unit retains its initial rated efficiency.

easily installed A complete and automatic package, the SCALEFREE 230 was installed by the maintenance crew at the plant in 16 manhours. Only inlet and outlet piping and simple electrical connections were required for the installation. The heater can be operated with any type of industrial gas – manufactured or natural.

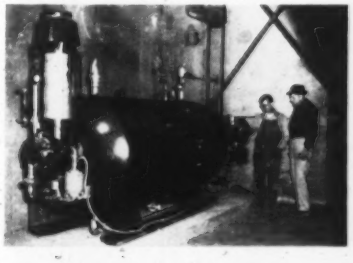
pre-krete®-lined General Refractories has assured itself of rust-free service water by specifying that the tank interior be lined with PRE-KRETE – a cement-base, plasticized material of high corrosion resistance. "It's just the thing for us," states the Plant Superintendent, "our water here in Carter County is full of minerals."

p-k scalefree 230 is available in plain steel or with linings of Pre-Krete or copper. Factory insulation optional. Storage capacities from 250 to 4,000 gallons; recovery sections from 390,000 to 2,215,000 BTU.

*Patent pending

Patterson Kelley

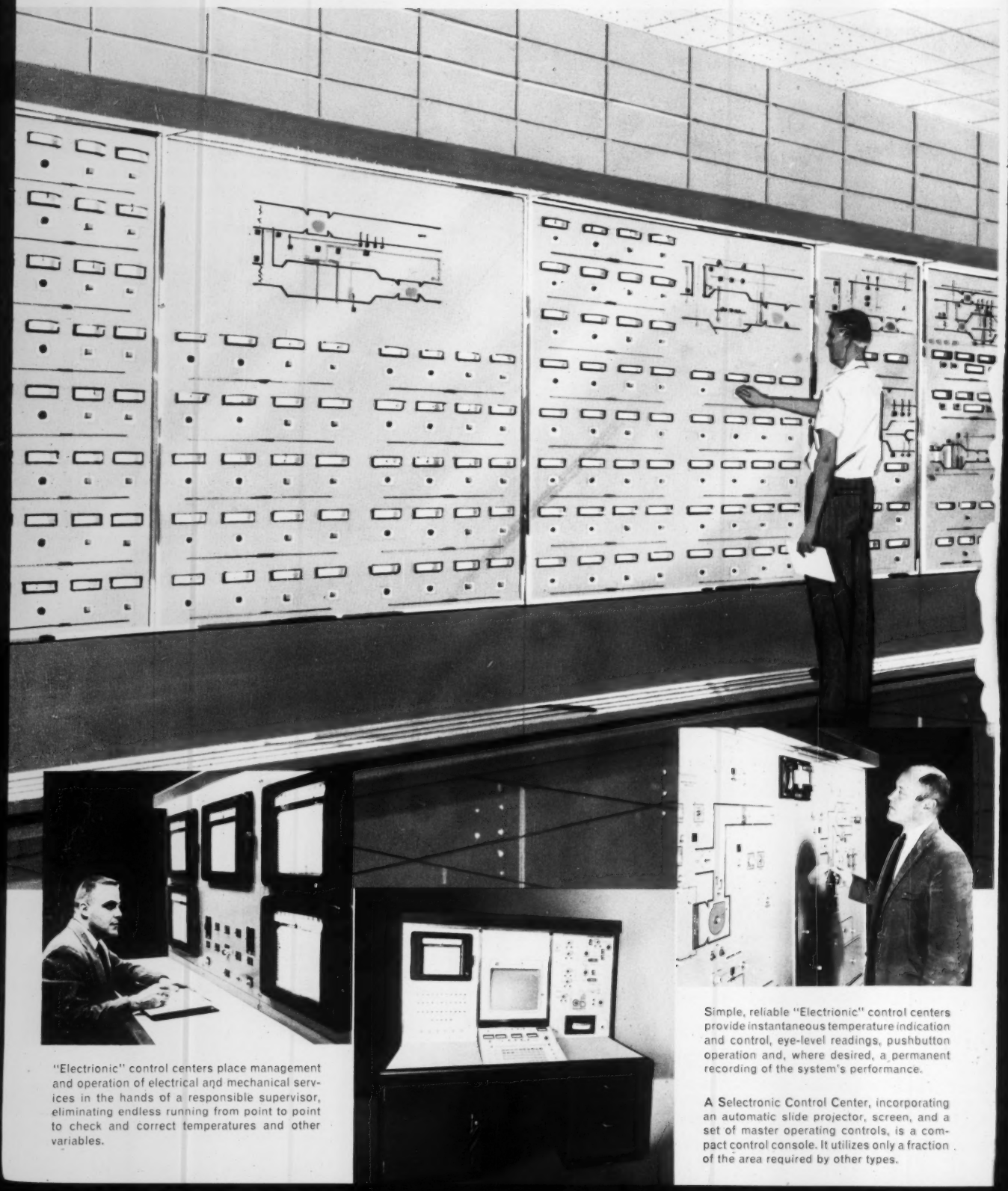
Water Heater Division, East Stroudsburg, Penna.



Installation of the SCALEFREE 230 took maintenance crew at General Refractories only 16 manhours.

For complete engineering and performance data SEND FOR P-K BULLETIN NO. 4

From Barber-Colman **Mastermind for**



"Electronic" control centers place management and operation of electrical and mechanical services in the hands of a responsible supervisor, eliminating endless running from point to point to check and correct temperatures and other variables.

Simple, reliable "Electronic" control centers provide instantaneous temperature indication and control, eye-level readings, pushbutton operation and, where desired, a permanent recording of the system's performance.

A Selectronic Control Center, incorporating an automatic slide projector, screen, and a set of master operating controls, is a compact control console. It utilizes only a fraction of the area required by other types.

McCormick Place

Complete centralized "Electrionic"® control for 36 million cubic foot "oasis"

You have to think big when you think about McCormick Place, Chicago's new $35-million exhibition hall. It covers almost ten acres, has an exhibit area the size of six football fields, contains a 5000-seat theater.

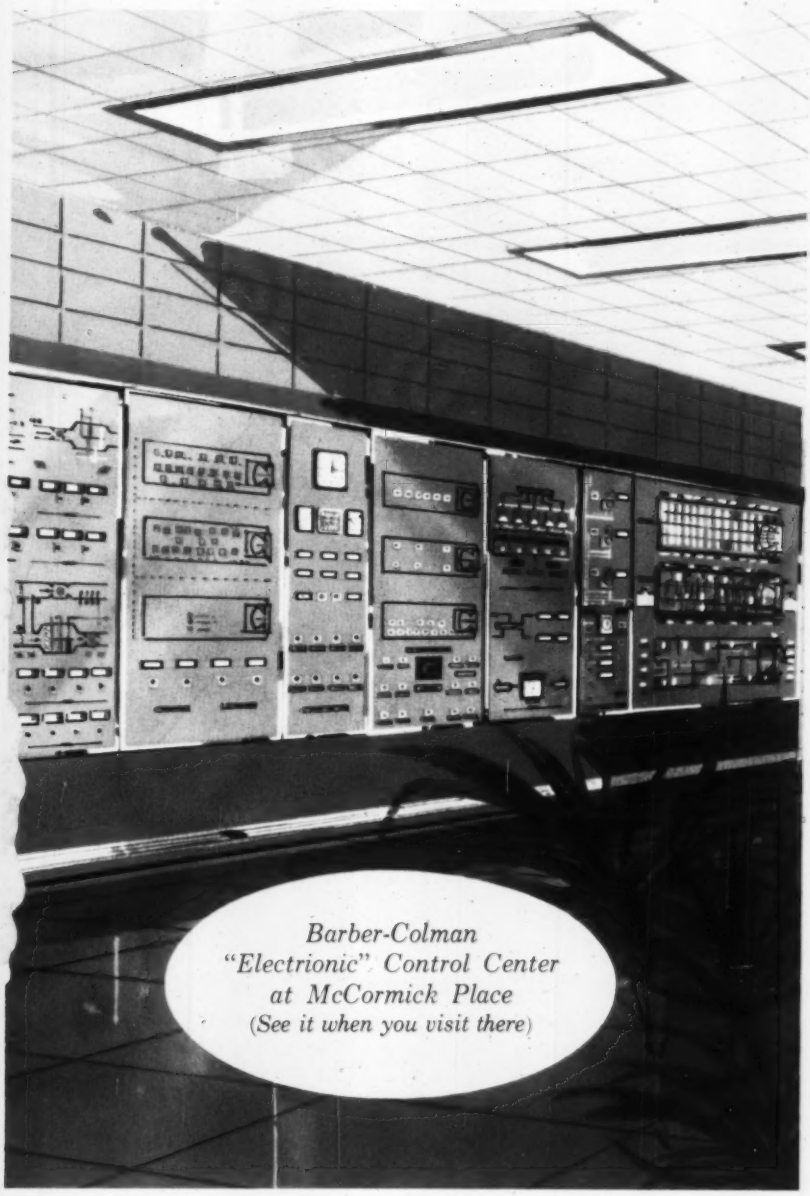
A Barber-Colman "Electrionic" Climate Control Center is the brain for the electrical nerve system of this building. It senses temperatures at more than 145 locations . . . reports them at the speed of light . . . corrects for the slightest deviation before you can detect any change . . . creates an oasis of comfort for up to 30,000 people at one time.

The 36-foot-long control panel monitors the entire air conditioning system—fans, dampers, pumps, motors, valves, and other equipment including Barber-Colman high-velocity air distribution control units. It maintains a continuous record of boiler fuel and water consumption.

A part of the panel is given over to lighting control. Here the operator can switch lights on and off anywhere in the building, as well as control their intensity and color to set the mood for any event.

Remote control centers for commercial air conditioning, heating, and ventilating were *originated* by Barber-Colman. Today, after many years of proven application, the Electronic Control Center is the most logical and efficient method of controlling a building's electrical and mechanical functions. There is no building too large or too small to benefit from its economy and reliability.

For complete information, consult your Barber-Colman Automatic Controls field office, or write: *Barber-Colman Company, 1300 Rock Street, Rockford, Illinois.*



Barber-Colman "Electrionic" Control Center at McCormick Place (See it when you visit there)

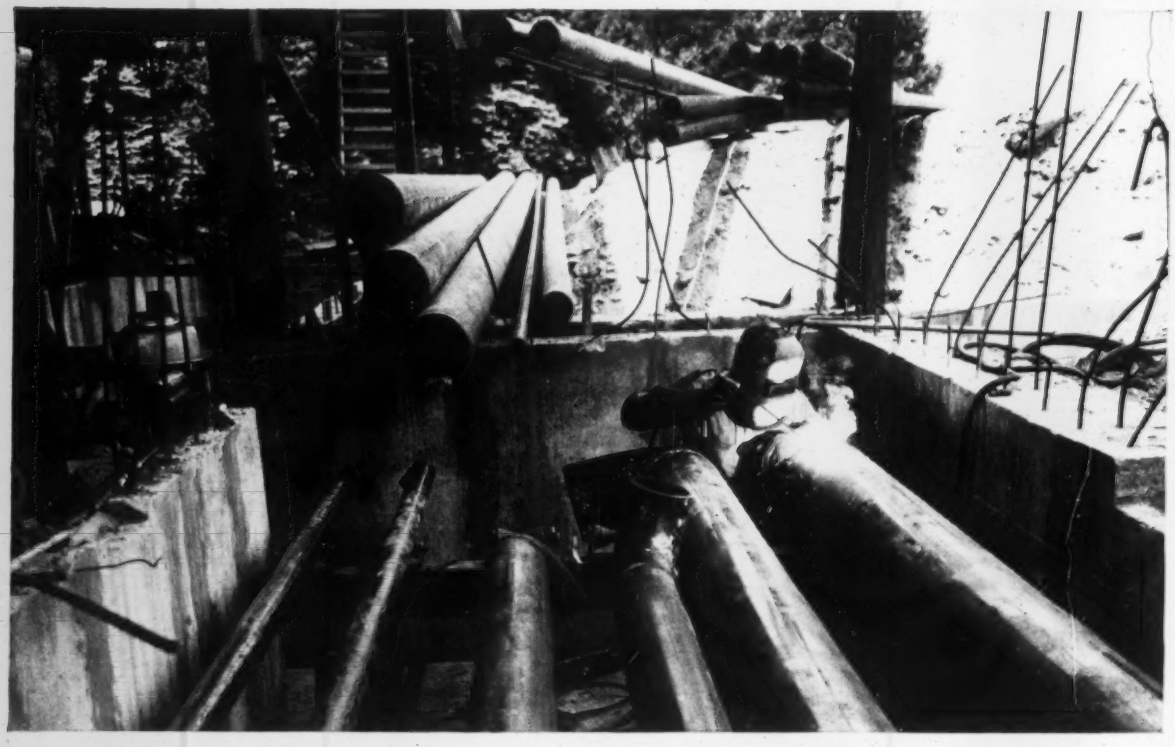
BARBER-COLMAN

. . . where originality works for you

Ask for new brochure F-8031-1 which describes the benefits of centralized remote control centers and explains the unique advantages of the Barber-Colman "Electrionic" system.

BARBER COLMAN

KEEP PACE WITH ELECTRICITY



STEEL PIPE

for the ultra-modern Univac® building

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Remington Rand Univac,
Division of Sperry Rand Corp.
ARCHITECT & ENGINEER
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GENERAL CONTRACTOR
Wark & Company
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Cooney Bros., Inc.
D. N. Supply Co. of New Jersey
J. Levitt, Inc.
Pesco Pipe & Supply Co.

This striking new computer-engineering center, just outside Philadelphia in Blue Bell, houses almost 1,000 people in some 2½ million cu ft of air-conditioned space. Automatic solar controls, operating vertical louvers on the south facade of the office building help to minimize the air-conditioning load. Some 165 tons of Bethlehem steel pipe were required for the heating and air conditioning alone. Drainage and vent lines, too, are made up of Bethlehem pipe.

When you compute piping costs for that next job, the odds are good your answer will point to steel as the most economical piping. Steel pipe combines low cost with durability. Its strength is unexcelled for safety; yet, it is readily weldable, and cuts and threads easily for fast installation. There's steel pipe for every purpose, and it's available everywhere from stock.

And be sure to insist on *steel* pipe Made in U.S.A.

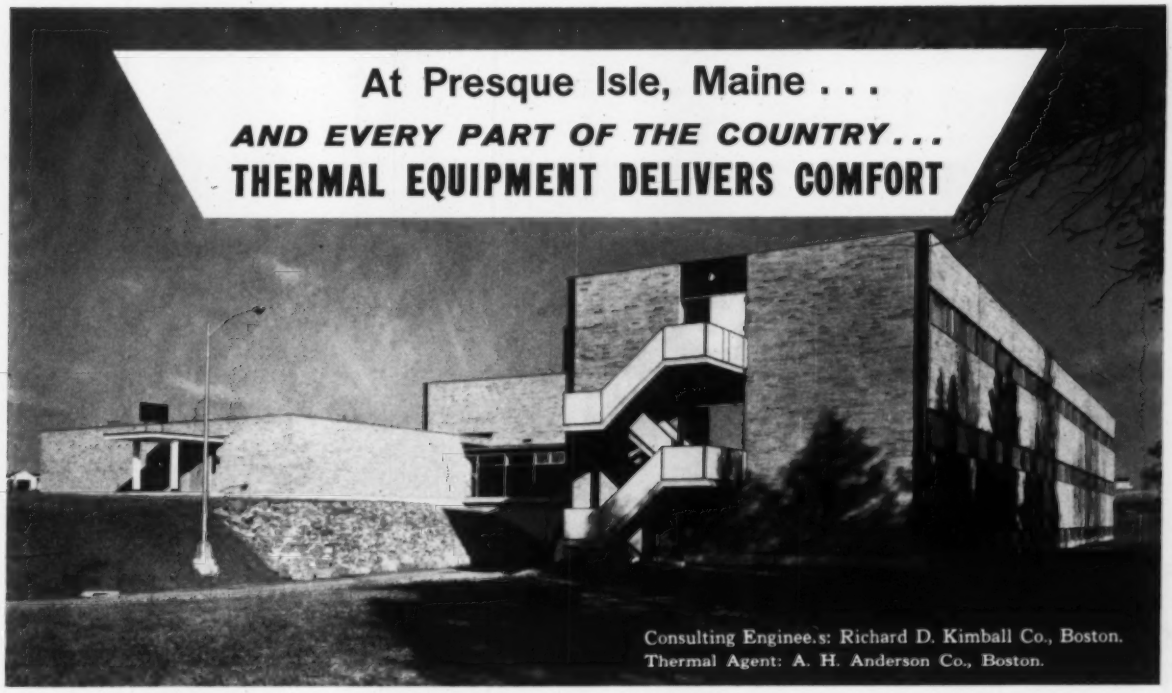
Steel

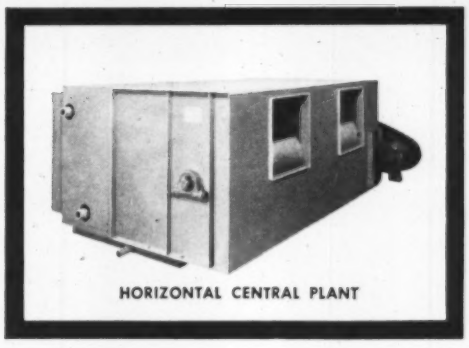
For Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL


At Presque Isle, Maine . . .
AND EVERY PART OF THE COUNTRY . . .
THERMAL EQUIPMENT DELIVERS COMFORT
Consulting Engineers: Richard D. Kimball Co., Boston.
Thermal Agent: A. H. Anderson Co., Boston.


HORIZONTAL CENTRAL PLANT

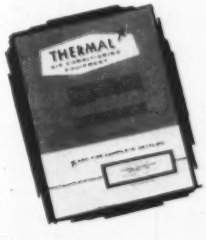
Gould Memorial Hospital in Presque Isle, Maine, uses Thermal units for its dependable air conditioning and ventilating system.

Used in a growing number of hospitals and all types of buildings, from air terminals to zoos, the quality and dependability of Thermal equipment brings comfort to occupants, satisfaction to owners, and confidence to architects and engineers.

The Thermal line of finer air conditioning and ventilating equipment is one of the most comprehensive on the market.

Complete details on Thermal equipment that you can specify with confidence are available.

New! Condensed 6 page, 2 color brochure briefly describes the Thermal line. Write for your copy.



A few of the other hospitals using Thermal equipment:

NAME	LOCATION
Henry County Hospital	Abbeville, Ala.
Jackson Hospital	Montgomery, Ala.
Park View Memorial Hospital	Arlington, Calif.
Jackson Memorial Hospital	Miami, Fla.
Mercy Hospital	Miami, Fla.
Cloverleaf Hospital	Miami, Fla.
Augustana Hospital	Chicago, Ill.
Cushing Memorial Hospital	Leavenworth, Kan.
Our Lady of the Lake Hospital	Baton Rouge, La.
Southern Baptist Hospital	New Orleans, La.
Van Buren Hospital	Van Buren, Maine
Medfield State Hospital	Medfield, Mass.
Midway Hospital	St. Paul, Minn.
Mounds Park Hospital	St. Paul, Minn.
Jefferson Davis Memorial Hospital	Natchez, Miss.
Cedar County Memorial Hospital	Elderado Springs, Mo.
St. Elizabeth Hospital	Lincoln, Nebraska
Charlotte Memorial Hospital	Charlotte, N. C.
Lea County Hospital	Hobbs, New Mexico
Anadarko Hospital	Anadarko, Okla.
Haskell County Hospital	Stigler, Okla.
Hillcrest Memorial Hospital	Tulsa, Okla.
Columbia Hospital	Pittsburgh, Pa.
Roper Hospital	Charleston, S. C.
Spohn Hospital	Corpus Christi, Texas
Cook Memorial Hospital	Ft. Worth, Texas
Hermann Hospital	Houston, Texas
Memorial Hospital	Houston, Texas
Mercy Hospital	Houston, Texas
Tuberculosis Hospital	Houston, Texas
Institute for Rehabilitation & Research	Houston, Texas

(Plus a number of government operated hospitals)

Quality Products Since 1945

THERMAL ENGINEERING CORPORATION

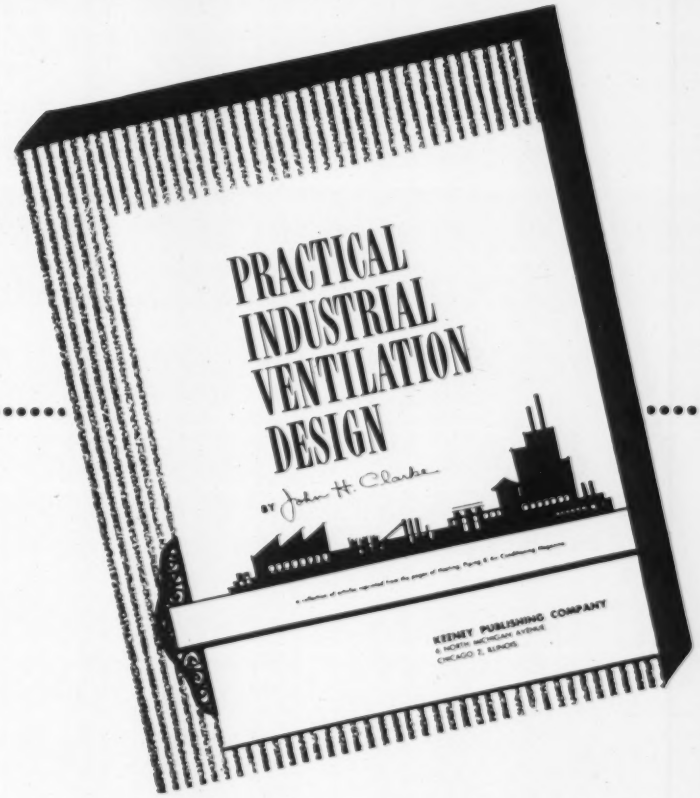
2605 W. DALLAS • P. O. BOX 13254
HOUSTON 19, TEXAS

AGENTS IN PRINCIPAL CITIES

Let's Keep Rolling Ahead

We Americans invented mass production, then we *had* to build mass demand to keep the wheels turning. For this purpose we called upon advertising – the most effective and economical means of creating mass demand. Soon we had more jobs, higher incomes, and better living conditions. And there isn't any limit to how much farther we can go, if we just keep it rolling!

NOW AVAILABLE IN HANDBOOK FORM!



10 VALUABLE ARTICLES ON INDUSTRIAL VENTILATION

BY JOHN H. CLARKE

Ten of the most valuable articles *Heating, Piping & Air Conditioning* has ever published on industrial ventilation are now available in permanent handbook form.

These articles were written exclusively for HPAC by John H. Clarke, one of the country's foremost authorities on industrial ventilation. In them he offers readers a wealth of ideas *not available anywhere else* on subjects like these:

1. How to select industrial ventilation equipment.
2. How to design built-up systems.
3. How to design for heat recovery.
4. How to design makeup supply air systems.

Never before has there been a reference book on this subject that offered so many practical, money-saving, experience-proven facts on this subject—in such a compact, convenient form.

Engineers and contractors concerned with any phase of plant ventilation—design, installation, or maintenance—will find this book an invaluable source of information.

Copies are for sale at $1.50 each.

Use the convenient coupon below to place your order.

To: HEATING, PIPING & AIR CONDITIONING, 6 North Michigan Ave., Chicago 2, Illinois

Send me a copy of "Practical Industrial Ventilation Design" by John H. Clarke.

Name ..... **Title** .....

Company .....

Street Address .....

City ..... **Zone** ..... **State** .....

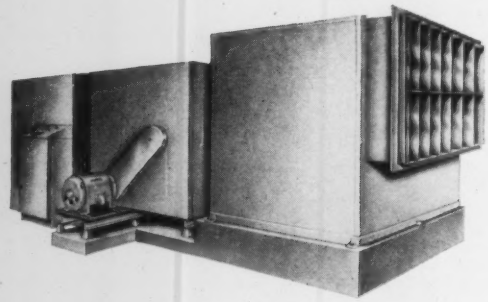
☐ **Send** ..... **copies of "Practical Industrial Ventilation Design" @ $1.50 per copy (less discount of 20% on quantities of 10 copies or more).**

☐ **Payment of $**..... **enclosed** ☐ **Send invoice**

Today, more than ever before, it's necessary to get the most for your equipment dollar. The use of quality units will provide the greatest return because they give a longer service life and require far less maintenance. 'Buffalo' has always built this type of equipment. Here are the 'Buffalo' Quality units featured at the recent ASHRAE Show.

*A "Progress Report" from 'Buffalo'-at Chicago**

* At Chicago, you saw a sample of the "Best of Buffalo" in both improved and totally new air and liquid handling equipment—ready to meet your most advanced requirements. Here is our 1961-best, the culmination of everything we've learned and developed, these past 84 years. So why settle for less than 1961 equipment by 'Buffalo', the latest and best to match the latest high standards of your installations!

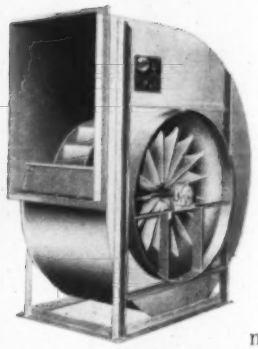


NEW HIGH-PRESSURE ZONE CONDITIONING!

Here's an all-new 'Buffalo' design for those modern high-pressure, small-duct installations, with features available nowhere else! It incorporates the famous 'Buffalo' Type BL Fan described on the next page — individual factory-sized zone dampers for proper distribution — horizontal or vertical up-discharge to fit system requirements—neoprene flexible connection between sections for ease of installation, minimum vibration and sound transfer to ducts — angled coils to save space — and traditional 'Buffalo' quality construction throughout. The electronic air cleaner section you saw at the show is a "plus" option that offers you zone conditioning at its finest!

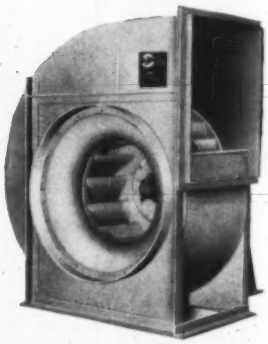
"PACKAGE" AIR COOLED CONDENSER!

There's nothing on the market to match these units in design, construction or performance. The unique opposed-blade by-pass damper provides super-accurate control. Extra low silhouette design and solid construction assure dependable carefree operation. In addition, you get multiple fans for full capacity or reduced operation. Check on one of many new installations.



NO BETTER VENTILATING FAN AT ANY PRICE!

The 'Buffalo' Type BL Fan has proven itself more efficient on more jobs than any other in Class 1 and 2 applications! The famous 'Buffalo' backward-curved bladed wheel, the smoothly curved inlet wheel flange matching the dished housing inlet bell—the stationary inlet vanes—provide the quietest, most stable and efficient performance available in its class. Optional variable inlet vanes give efficiencies within 1% of rating! A "hit" at the show, the BL is a sure performer on any job, and a lasting source of satisfaction to the owner.



HIGH-PRESSURE AIR FOR HIGH-PRESSURE SYSTEMS!

Get further engineering specs on this fan's high, broad performance curve, and use it on your next Class III or IV jobs calling for peak efficiency. The 'Buffalo' Airfoil Fan is the modern answer to your high-pressure air moving jobs where you require maximum efficiency over a broad operating range. Same highly-developed 'Buffalo' housing as the "BL" Fan, same quality construction. You saw the 'Buffalo' Airfoil at the Show.

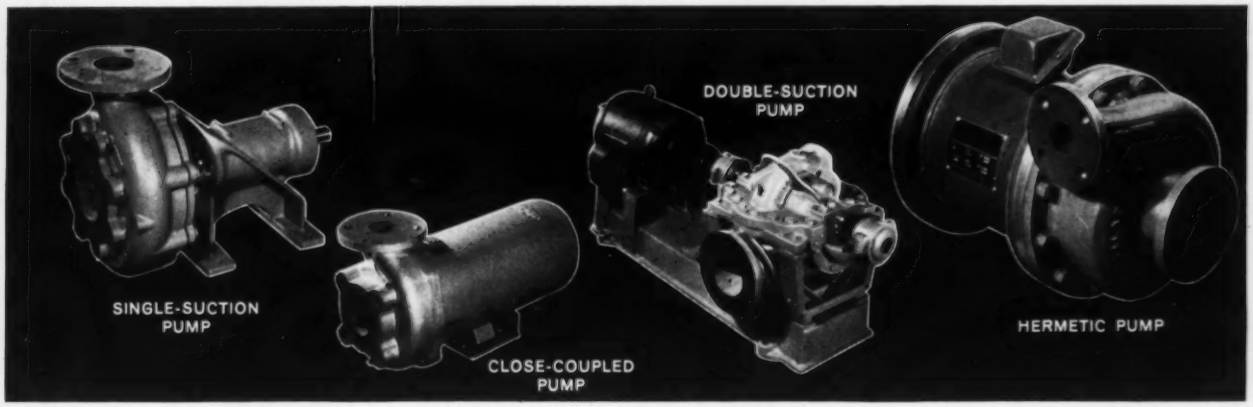
ALL NEW PUMP DESIGNS!

A NEW ECONOMY SINGLE-SUCTION PUMP. No compromise in quality 'Buffalo' construction, this new single-suction pump has open type mounting plus selective discharge position, standardized interchangeable parts and a rotor assembly removable without disturbing piping. An all-around pump for 1001 jobs at low initial cost and minimum operating cost.

COMPACT, LOW-COST PACKAGE PUMP. Here's an efficient, new close-coupled 'Buffalo' Pump with a wide range of clear-water applications, including air conditioning! It features ball-bearing design with mechanical seal and stainless steel shaft. As with all 'Buffalo' Pumps, its parts are fully standardized for interchangeability.

NEW 'BUFFALO' HERMETIC PUMP. Here's the pump to use where leakage could be costly or dangerous — it doesn't leak. This new close-coupled pump delivers against pressures up to 400 psi! New design wear-compensating bearings take heavy thrust loadings. Available in a wide range of materials to handle a variety of liquids.

NEW DOUBLE-SUCTION EFFICIENCY! The 'Buffalo' Double Suction Pump has been the standard of the industry for efficient high-volume liquid moving. This new design is even better! Suitable for working pressures up to 250 psi and temperatures to 300° F., it is the most efficient and trouble-free clear water pump you can buy.



"Buffalo"

AIR HANDLING DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

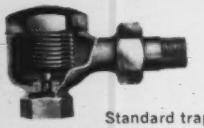
'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

ONE STOP SHOPPING FOR AND AIR CONDITIONING

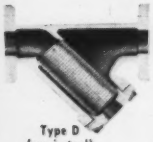
SARCO RADIATOR TRAPS, TYPE H



Sarco Type H Radiator Trap, angle pattern

Standard traps for all types of two-pipe steam heating systems. Suitable for pressures from highest vacuum to 25 psi. Require no adjustment in service. Removes air and condensate from radiators or convectors rapidly, completely, without steam waste or noise. Vertical traps are designed for bottom connected convectors to facilitate installation and cleaning.
Bulletin No. 155

SARCO PIPELINE STRAINERS



Type D (semi-steel) flanged, 125 and 250 psi

Types AT (semi-steel) 250 psi and BT (brass) 250 psi

Type CT (cast steel) 600 psi

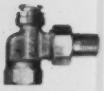
For condensate, steam, water, oil, air, gas, and other piped fluids

Effective, inexpensive insurance against costly shutdowns and heavy repair bills. Installed ahead of the equipment, they protect the working parts of temperature and pressure regulators, steam traps, pumps, meters, burners, compressed air equipment, hydraulic systems, lubricators, and nozzles.

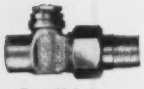
Standard screen used in Sarco strainers is constructed to prevent particles from by-passing the screen at the ends.

Rigid construction prevents rupture of screen when sediment creates abnormal pressure differentials. No weave-crevices to trap particles, and, therefore, more readily cleared by the use of the blow-down connection.
Bulletin No. 1210

SARCO BALANCING FITTINGS



Type 10 Series Angle Union Pattern Thread Type



Type 40 Series Straightway Union Pattern Sweat Type

Type 50 Series Straightway Screwed Pattern

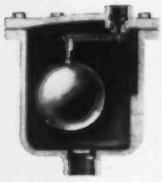
Type 60 Series Straightway Soldered Pattern

For balancing branch or circuit resistance of radiators, convectors, heating or cooling coils, unit heaters, and other heat transfer surfaces employing hot or chilled water. Unique solid segment stem assures linear straight line flow not obtainable with butterfly stems. Maximum water pressure 200 psi cold liquid—non-shock; 175 psi, 250°F. temperatures.

Available either in standard construction or with integral manual air vent in 3 standard patterns: angle union, straightway union, and straightway female connection. Both screwed end and sweat types. Twenty-six different patterns and sizes.

Bulletin No. 225

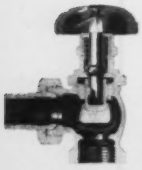
SARCO HIGH CAPACITY AIR ELIMINATORS FOR WATER



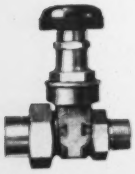
Type 13W For Water Heating and Cooling Systems

Type 13W and 13WH vent air from radiant or hot water heating systems, high pressure, high temperature hot water lines, chilled and condenser water lines in air conditioning installations, and process liquid lines — eliminate air pockets that prevent or retard circulation. Float-controlled discharge valve vents air rapidly through large orifice. Float action prevents escape of fluid.
Maximum pressure ratings: No. 13W — 150 psi; No. 13 WH — 300 psi.
Bulletin No. 170

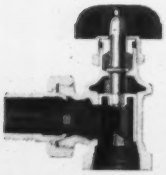
SARCO VALVES FOR WATER



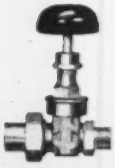
No. 37 Quick-Opening



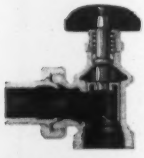
No. 129 Convector and Radiator Gate



No. 157 Sleeve Type



No. 127 Convector and Radiator Gate



No. 167 Sleeve Type

Bulletin No. 225

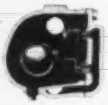
SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

QUALITY HOT WATER, STEAM, SPECIALTIES...FROM SARCO

SARCO FLOAT-THERMOSTATIC STEAM TRAPS FOR 0-15 PSI



Type FT ¾", 1", and 1¼" Bodies and covers of semi-steel (rated at 125 psi). Stainless steel valve and mechanism.

Type FTL 1½" and 2" Bodies and covers of semi-steel (rated at 125 psi). Stainless steel valve seats. Renewable bronze valve heads.

Sarco Float-Thermostatic steam traps discharge condensate at steam temperatures continuously and without shock. Air binding impossible — separate thermostatic air vents remove automatically and continuously all air and incondensable gases reaching the trap. Balanced pressure vent self-adjusts to all operating pressures, and location above condensate level permits discharge of air and gases reaching trap after start up. Do not require adjustment when pressures change.

Bulletins No. 450 & 455

SARCO AIR ELIMINATORS FOR STEAM

For Low Pressure Steam Heating Systems

Type 6, 6T, and 13-S Air Eliminators vent air from radiators and piping rapidly and completely. Float valve design prevents spillage. Check valve prevents air return under vacuum.

Types 6 and 6T have brass heads and seats, cast iron body. Body of 13-S is semi-steel with stainless steel head and seat. Pressures to 15 psi.

Bulletin No. 170

Type 13-S Air Eliminator

Type 6 Air Eliminator

SARCO DOMESTIC WATER BLENDERS, TYPE DB

Maximum Working Pressure, 125 psi

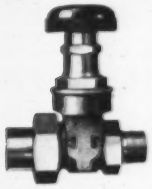
Designed for use with submerged heating coils in residence or apartment heating boilers and external submerged coil heaters piped to heating boilers, where the pressures on cold and hot water supplies are balanced. Because the water in the boiler varies in temperature with the steam pressure carried, or the heating load, service hot water may be delivered to the fixtures at boiler water temperature.

The DB blender prevents this by automatically adding enough cold water to the hot discharge from the heater coil to maintain the desired moderate water temperatures to the fixtures.

Adjustable between 120°F. and 160°F. Any other range, covering 40°F. can be supplied at extra charge.

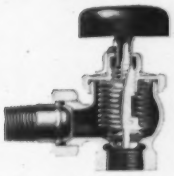
Bulletin No. 800

SARCO RADIATOR VALVES FOR STEAM



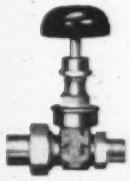
Gate Valve, Reinforced Packless Bonnet

129 — Double wedge disc convector gate valve with female union inlet, male threaded outlet. Max. pressure — 60 psi.



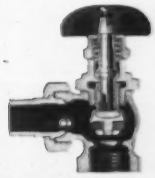
Bellows Packless Radiator Valve

45A — Valve stem positively sealed by flexible bellows of heavy-wall, helically-corrugated, bronze tubing. Modulating, non-modulating, and lock-shield types, angle and straightway patterns. Max. pressure — 25 psi.



Gate Valve

127 — Double wedge disc gate valve, female union inlet, male threaded outlet. Can be repacked under pressure. Available in a variety of connections. Max. pressure — 125 psi.



Reinforced Packless Bonnet

1141 — Vapor-tight stem, quick-opening, non-rising, with renewable composition cone disc. Max. pressure — 60 psi.

Bulletin No. 225

Plus . . . SARCOTHERM TEMPERATURE CONTROL SYSTEMS

These outdoor weather-compensated heating control systems are custom planned for schools, office buildings, hospitals, apartment buildings, developments.

- Maintain uniform inside temperature by automatically adjusting flow of hot water or steam to compensate for changes in outdoor temperature and room load demand.
- Insure low installed cost . . . with fewer controls, less wiring.
- Special drawings furnished for each job. On-the-job assistance from Sarcotherm's field engineers.

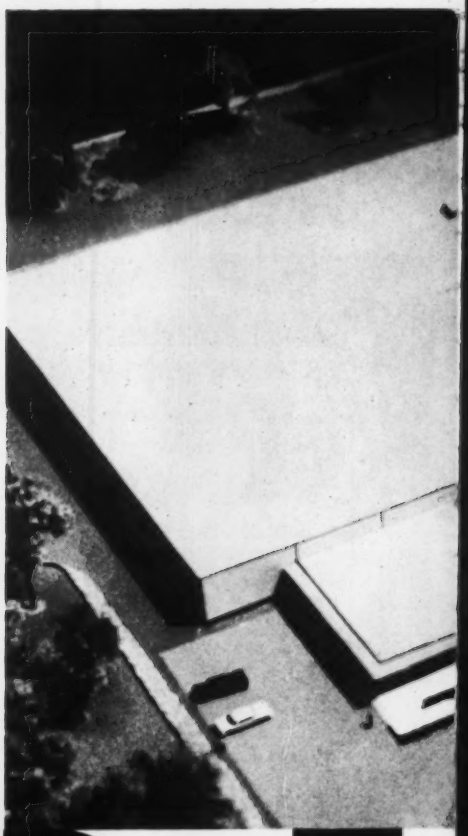
ALSO AVAILABLE: steam traps, Sarcofin and Sarcopak radiation, access boxes, temperature controls, vacuum and condensate pumps, and thermometers.

5924

SARCOTHERM

SARCOTHERM CONTROLS, INC.
AN AFFILIATE OF SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.

CONTROL SYSTEMS FOR STEAM, HOT WATER, AND RADIANT HEATING



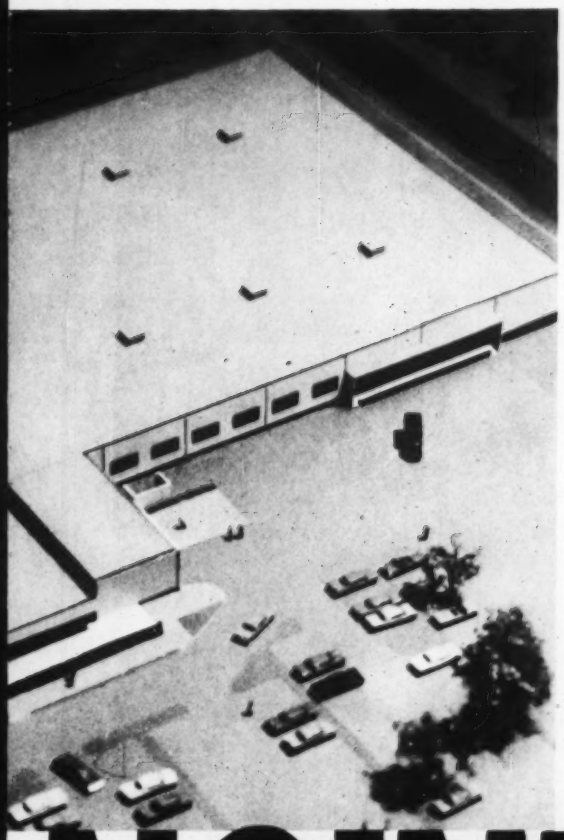
OPTIMUM SAVINGS FORECAST FOR NEW SINGER DISTRIBUTION CENTER THROUGH

DIVIDEND E

The new Singer Distribution Center at Syosset, Long Island, is a good example of what Dividend Engineering can mean to owners of a new building. This modern structure has a roof area of 104,000 square feet. Too little or too much roof insulation could result in wasteful expenditures for power, fuel, equipment or material. The architects and engineers determined the correct thickness by using Dividend Engineering data to analyze the economics of various thicknesses. They found that four inches of Fiberglas* Roof Insulation was the optimum thickness for maximum savings in heating and cooling costs. The increased thickness cost $38,000 more, but the projected savings more than justify the expense. Such savings make the production and comfort benefits of year-round air conditioning an economic possibility for more and more industrial and commercial structures.

Let us demonstrate Dividend Engineering on one of your current projects. Contact your local Fiberglas representative, or write Owens-Corning Fiberglas Corporation, Industrial and Commercial Division, 717 Fifth Avenue, New York 22, New York.

*T-M. (REG. U.S. PAT. OFF.) O-C.F. CORP.



ARCHITECTS: Fordyce & Hamby
ENGINEERS: Guy B. Panero Engineers

DIVIDENDS ON A $38,000 INVESTMENT IN ADDITIONAL INSULATION:

$91,000 SAVED ON INITIAL EQUIPMENT

The four inches of insulation will reduce the heat loss or gain through the roof by 70 per cent as compared to one inch of insulation. This made possible a $91,000 projected saving in the initial cost of heating and cooling equipment.

$8,930 ESTIMATED ANNUAL OPERATING SAVING

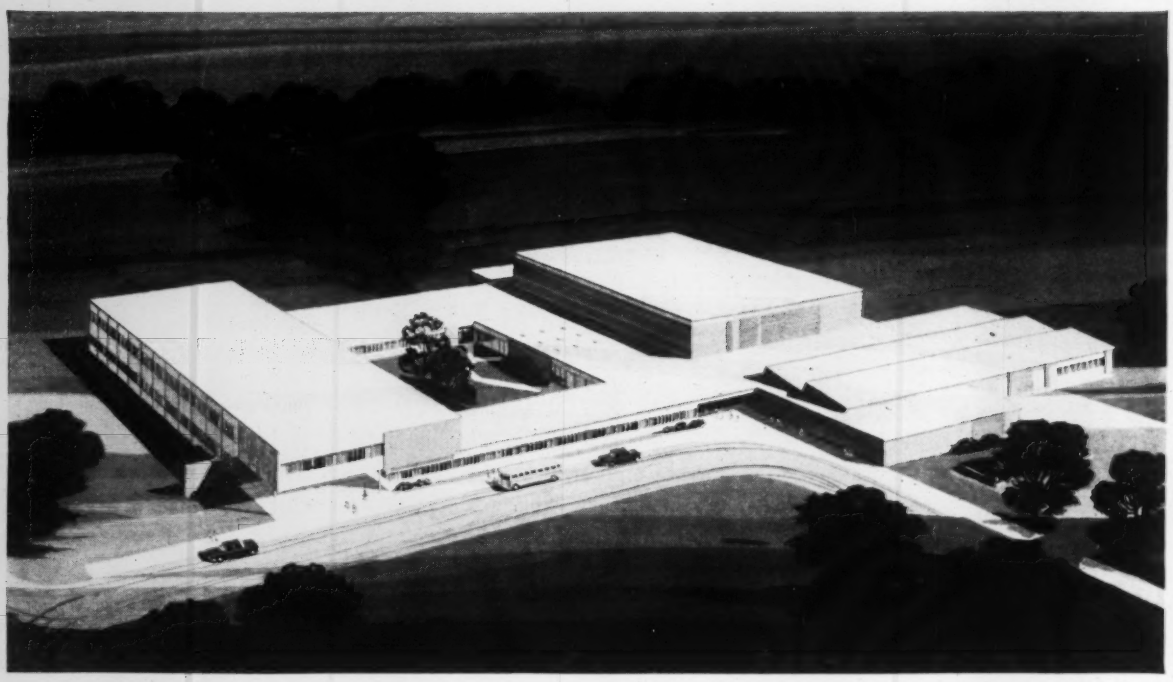
$5,900 projected savings on fuel and power; $280 on maintenance; and $2,750 in interest.

NGINEERING

■ A SERVICE OWENS-CORNING WILL PROVIDE TO DEMONSTRATE TO BUILDERS, DESIGNERS, MANAGEMENT AND FINANCIAL GROUPS THAT OPTIMUM USE OF FIBERGLAS MATERIALS CAN RESULT IN REDUCED INITIAL AND OPERATING COSTS AND IMPROVED BUILDING PERFORMANCE.

OWENS-CORNING RESEARCH pioneers in making things better with Fiberglas

OWENS-CORNING FIBERGLAS



In the new Batavia Senior High School, Batavia, New York...

NEW CARRIER HEATING AND VENTILATING SYSTEM PROVIDES 8 MAJOR ADVANTAGES YET COSTS LESS

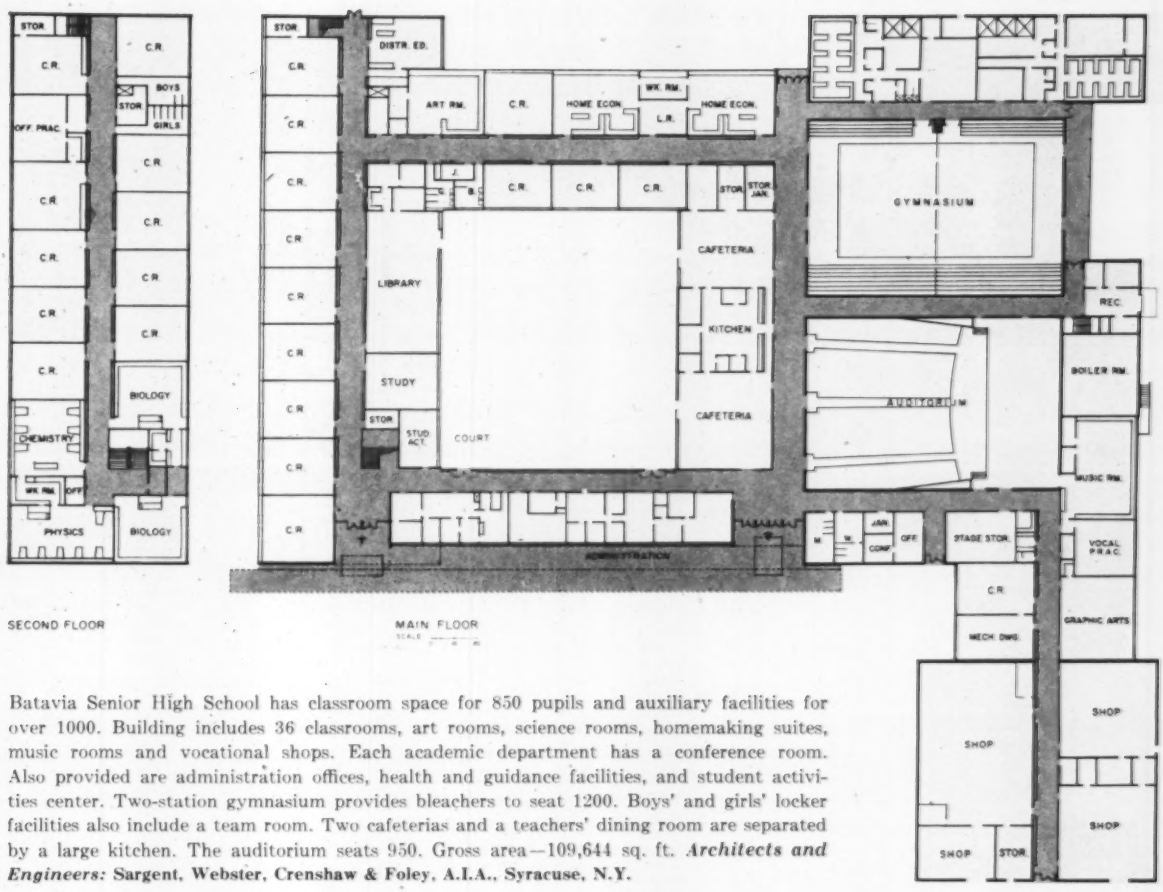
This modern high school offers an excellent example of how any new school can enjoy a superior heating and ventilating system at less than the cost of ordinary unit ventilators. And this new kind of system is ready for immediate conversion to year-round air conditioning with the simple addition of packaged refrigeration equipment in the machine room.

In planning Batavia Senior High, the designers considered unit ventilators and several popular central station systems. They carefully compared the performance characteristics, maintenance requirements, first cost and operating cost of each method. Their conclusion: The new Carrier 37E All-Air Weathermaster* System provides the highest quality automatic heating and ventilation currently available to schools. It is the easiest to convert to complete year-round air conditioning. It costs 10% less, installed, than the next best method. And it costs less to operate and to maintain than other automatic systems.

The eight important advantages of the 37E Weathermaster System which led to these conclusions are listed on the opposite page. They are unique because Carrier 37E units are the only room terminals which combine the performance benefits of the induction principle with either high or low velocity air distribution and the superiorities inherent in all central station systems.

If you are designing a new school, it should be well worth your while to look into the Carrier 37E All-Air Weathermaster System—either for heating and ventilation only, or with an eye to future air conditioning. The nearby Carrier office will be glad to give you complete facts on this advanced system. Or you may write to Carrier Air Conditioning Company, Syracuse 1, New York.

*Reg. U.S. Pat. Off.



Batavia Senior High School has classroom space for 850 pupils and auxiliary facilities for over 1000. Building includes 36 classrooms, art rooms, science rooms, homemaking suites, music rooms and vocational shops. Each academic department has a conference room. Also provided are administration offices, health and guidance facilities, and student activities center. Two-station gymnasium provides bleachers to seat 1200. Boys' and girls' locker facilities also include a team room. Two cafeterias and a teachers' dining room are separated by a large kitchen. The auditorium seats 950. Gross area—109,644 sq. ft. ***Architects and Engineers:*** **Sargent, Webster, Crenshaw & Foley, A.I.A., Syracuse, N.Y.**

Only the Carrier 37E All-Air Weathermaster System offers these 8 advantages for heating and ventilating

1 Positive ventilation and air circulation under all conditions and seasons for improved odor dilution. Constant air volume from units.

2 Quieter operation—no fans or other moving equipment in classrooms, with all powered equipment located in machine room for easy servicing.

3 Superior air filtering at central station—minimum filter maintenance.

4 No costly wall openings, subject to rain and wind leakage, required in classrooms for ventilation air.

5 No operation of fans required for night and week-end heating, with gravity heating handling the load.

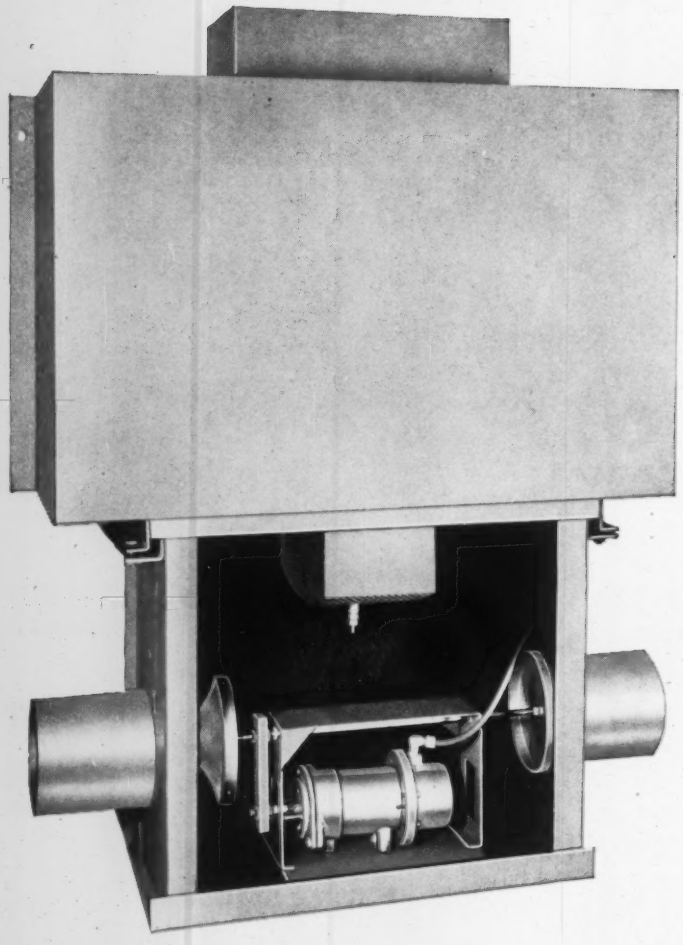
6 Individual temperature control in every room solves zoning problems; air damper assures easy initial system balancing, requires no adjustments thereafter.

7 Valuable classroom floor and wall space is saved by the compact units; cabinet only eight inches deep.

8 Easily and economically converts to full-year-round air conditioning at any future date with simple addition of packaged water chilling machine in central apparatus room. No revision of classroom units, controls or air ducts required. Condensate drains not needed. Nominal conversion cost about 65c per sq. ft., or less.

Carrier ***Air Conditioning Company***

ALL NEW AGITAIR® MIXING BOXES



A MAJOR DEVELOPMENT IN CONSTANT CONTROL AND DISTRIBUTION OF HIGH VELOCITY TEMPERED AIR

A simple design of the all new AGITAIR Type "O" series, high velocity mixing boxes eliminates all troublesome linkages and pivots. Only one motor is employed to operate the inlet valves which are driven directly, guaranteeing instantaneous response with no lost motion or backlash.

The mixing valves proportion the hot and cold air in response to the room thermostat and the unique AGITROL volume regulator guarantees constant control of air delivery at the required volume.

Comprehensive noise attenuation tests were conducted to assure extremely low sound ratings for ceiling and under the window units. And for noiseless, draftless distribution of the conditioned air from these units, there is a complete line of AGITAIR diffusers and grilles from which to choose.

Technical catalog HV-100 contains complete performance data and dimensions on all AGITAIR units. Write for your copy today.

FEATURES

1. One motor — no linkages.
2. Aluminum inlet valves driven directly — instantaneous response . . . no lost motion . . . no backlash.
3. Unique AGITROL valve (constant volume regulator) actuated solely by the supply air.
4. Both mixing and attenuation chambers fabricated of galvanized or galvannealed steel . . . sealed to prevent air leakage.
5. Split fabrication of attenuation chamber permits dimension adaptation to meet most space limitations.

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AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST

you'll want to know...

Separate Contracts for Mechanical Systems Seen as Best Way to Eliminate Bid Shopping

SEPARATE BIDS are the only alternative to complete chaos in the building construction industry, according to Henry J. Couch, executive secretary of the Coordinating Committee of Mechanical Specialty Contractors Associations of Chicago. The bid shopping and peddling that result from the single bid are *not* an "exclusive problem of the contractor"—they also affect all of the other elements in the industry, he said.

Mr. Couch made these remarks at a recent meeting of the Construction Specifications Institute, Inc., in Chicago. He was discussing the principal role of the Coordinating Committee of Mechanical Specialty Contractors Associations. The Committee, chartered by the State of Illinois, represents collectively four mechanical specialty contractors associations in the city of Chicago.

In a brief explanation of the cause of bid shopping and peddling, Mr. Couch said that the Coordinating Committee realized early in its existence that certain jobs in the past were entirely free of any bid-shopping or peddling. The one thing that these jobs had in common was that they were all separately bid, he said.

From this observation and others, the "Chicago Plan for Separate Mechanical Specialty Contracting Bids" was formulated by the Committee. The "Chicago Plan" has since been described in a six page brochure of which almost 5000 copies have been distributed. Mr. Couch pointed out that because of a number of articles about the plan in various business magazines, particularly Heating, Piping & Air Conditioning, (see November 1960 HPAC, page 129) requests for this brochure have been received from all parts of the United States and even from some foreign countries.

Underpricing in bidding was described by Mr. Couch as a secondary consequence of bid shopping and peddling that is often overlooked. He stated that a too-low figure should be feared even more than a too-high figure. He explained that the high bid will at least get the job done, while the contractor who submits a too-low bid can hardly be expected to do an acceptable job. Thus, the owner, architect, engineer, supplier, and all in the industry are hurt.

Mr. Couch outlined what the four major mechanical contractor associations are doing to promote industry cooperation. He cited such activities as establishing standards, apprentice training, and coordinating joint activities as major efforts.

At the same meeting, L. H. Nettnin, consulting engineer, discussed some of the problems a consulting engineer has in the building construction industry.

Mr. Nettnin stated that from the consulting engineer's view, the biggest problem is to get a better exchange of information between the individuals involved in a job. He indicated that the problems associated with revision are partially

you'll want to know

the result of poor communication.

Mr. Nettnin concluded his talk on a philosophical note by stating that revisions are inevitable, and therefore, so are their associated problems. He quoted a poem that he believes reflects the consulting engineer's plight which is entitled "Revision," author unknown, but obviously an engineer:

The draftsman and the engineer
Are men of skill and vision
At least they are until they hear
The hated word -----REVISION.

The engineer with practiced eye
Surveys his grand design
The draftsman then expertly draws
Each complicated line.

"Complete," they sigh contentedly
"Miraculous precision"
Oh optimists; tomorrow bring
Catastrophe; REVISION

Revision one adds this new price
Revision two improves it
Revision three makes it just right
The number four removes it.

"You can't do this, you can't do that"
"We'll wait for a decision
But in the meantime just revise
The last revised revision."

Revise; revise; the very word
Fills engineers with dread.
Tho' die they must, they'll be revised
To make damn sure they're dead.

They hope that God's no engineer
When He makes His decision
If once they win their wings they hope
There'll be no last revision.

Harvard University To Conduct Air Cleaning Institute in June

AN INTENSIVE course on air cleaning will be held by Harvard University June 19 to 23 to provide graduate level training in theoretical and applied aspects of air and gas cleaning procedures and equipment. The course consists of lectures and laboratory sessions.

Preliminary or refresher sessions will afford a review of basic engineering principles in order that coverage of advanced material may be as comprehensive as possible. Topically, the course will include:

1. Basic theories and principles of aerosol and gas collection: particle dynamics and behavior.

2. Stack sampling methods and data evaluation: loading, particle size, efficiency.

3. Performance of typical air and gas cleaners: efficiencies, costs, applications to special industrial hygiene, and air pollution problems.

4. Laboratory demonstrations: illustrations of lecture material.

Student enrollment will be restricted to those actively engaged in the practice of industrial hygiene engineering or air pollution control. An academic background consisting of engineering or physical sciences is preferable but not a prerequisite provided that the candidate has a minimum field experience of eight years and a need for special training. Total enrollment for the course is limited to 40 persons due to the specialized nature of the laboratory requirements.

Applications will be processed by the Admissions Committee according to date received. No application will be considered unless accompanied by a registration fee of $50.00 which will be applied to the tuition of $150.00 if accepted. If the candidate is not accepted, the fee will be returned.

For further information, write to Leslie Silverman, SC.D., Harvard School of Public Health, 55 Shattuck St., Boston 15.

ASHRAE Chapter Asks for Member Poll On Laboratory Referendum

THE DECISION to close ASHRAE's Research Laboratory in Cleveland was discussed by John H. Clarke at the March 13th meeting of the Illinois Chapter of the American Society of Heating, Refrigerating and Air-Conditioning Engineers. Mr. Clarke, engineering design supervisor, Visking Co., reviewed the events leading up to the decision of the Board of Directors to close the lab (see You'll Want to Know, February, 1961, page 46) and what has been done since in the way of discussions with officers and in getting petitions signed to ask for a referendum of all members on this important matter.

Following Mr. Clarke's remarks, E. R. Teske, executive secretary of the Mechanical Contractors Chicago Association, moved that "the Illinois Chapter officers conduct a mail poll of the Illinois Chapter members on the question of holding a referendum to determine if the ASHRAE Research Laboratory should be discontinued." The motion also stated that the results of this poll should be sent to Robert H. Tull, newly elected president of the Society through a specially appointed committee in the Chapter. The motion was virtually unanimously accepted with 90 votes for and only two against.

Architectural Firm Develops Maintenance Manual for Office Building

A MAINTENANCE MANUAL that includes complete information on how to operate and service the $10 million worth of mechanical equipment in the new Indiana State Office Building at Indianapolis has been prepared by a Chicago architectural firm and an Indiana architect. The manual contains data on *every* piece of equipment in the heating, ventilating, electrical, plumbing, and fire control systems.

Prepared by Graham, Anderson, Probst & White, architects of the project, and architect Raymond S. Kastendieck, the reference manual consists of 10 volumes. It is considered to be the first manual of its type in the field.

The manual is a complete treatise on this particular building. It includes descriptive matter, theory, operation, maintenance, and service of the various mechanical systems. It gives information on each system, each component of that system, an inventory of each item of equipment, manufacturer, model number, size, capacity, parts price list, name of local agent or service organization together with other pertinent information. It is written in layman's lanuage as nearly as possible since many of the operating personnel will not be qualified engineers or electricians.

Preparation of the manual posed many problems for GAP&W. Although government agencies and various building owners admitted the need for such information, there was nothing in existence of such a nature. The firm had to perfect a format, create a workable reference system, and properly catalog thousands of items as the work progressed.

In its final form, the manual for the Indiana Office Building is contained in four cloth-bound volumes of approximately 200 pages each. These volumes are titled: Volume I — (A) Building Materials, (B) Building Equipment; Volume II — Kitchen Equipment; Volume III — Electrical and Fire Protection; and Volume IV — (A) Heating, Refrigeration, Air Conditioning, (B) Temperature Control, (C) Plumbing.

Three file-size cabinet drawers are required to hold the reference material that is keyed to the above volumes. Detailed drawings, wiring diagrams, flow sheets, isometrics pertaining to any piece of equipment is referenced and filed in the master file.

COUNTLESS BROCHURES and a mass of material from hundreds of suppliers shown above at left have been condensed into a 10-volume maintenance manual. Discussing the manual are Raymond S. Kastendieck, architect, (seated) and Marvin Probst, president of Graham, Anderson, Probst & White

C.E.C. Names Officers For 1961-1962

C.E.C.'s NEW PRESIDENT is Harold P. King, partner in the Sherman Oaks, Calif. consulting firm of King, Benioff and Associates. He was elected in February along with four other officers by C.E.C.'s board of directors.

To be installed with Mr. King May 5 at C.E.C.'s annual board of directors meeting are: first vice president, Cedric R. Acheson; second vice president, Sanford K. Fosholt; secretary, George J. Toman; and treasurer, George W. Poulsen.

Professor Jennings Honored by ASHRAE Life Members

AT the recent semiannual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers in Chicago, Professor Burgess H. Jennings of the Mechanical Engineering Department, Northwestern University, Evanston, Ill., and Director of the ASHRAE Research Laboratory, was given an award of merit in recognition of "outstanding work in the principles of the industry and profession." The nomination for this award came from the Life Members Club and was approved

you'll want to know

for the national organization by the Honors and Awards Committee.

This was the fourth such award made by the Life Members Club of the Society. Previous awards were made to Professor Linn Helander of Kansas State College in 1958, to Professor Merl Baker of the University of Kentucky in 1959, and to Professor Lester S. O'Bannon of the A. and M. College of Texas in 1960.

Professor Jennings has been a member of both of the former Societies for many years, and has served as president of the American Society of Refrigerating Engineers. He has received degrees from Johns Hopkins University and Lehigh University and has authored several textbooks and many technical papers on the subjects of air conditioning and refrigeration.

ASHRAE Elects New Officers At Chicago Meeting

NEWLY ELECTED officers of the American Society of Heating, Refrigerating and Air-Conditioning Engineers who accepted their positions for the next few months of this year at the recent meeting in Chicago are: president, Robert H. Tull, manager of product engineering, Westinghouse Electric Corp.; first vice president, John Everetts, Jr., consulting engineer, Charles S. Leopold firm; second vice president, John Fox, Jr., general sales manager, Minneapolis-Honeywell Regulator Co., Ltd; and treasurer, John E. Dube, vice president and general manager Alco Valve Co.

A total of 3319 members and guests were registered for the meeting. Visitors at the 15th International Heating and Air Conditioning Exposition totalled 21,627.

City of New Orleans Awards "Certificates Of Merit" to C.E.C. and GICE Presidents

THE city of New Orleans has awarded "Certificates of Merit" to Hueston M. Smith and Warren G. Moses for their "outstanding work" as presidents of the Consulting Engineers Council and the Gulf Institute of Consulting Engineers, respectively. The presentations were made at the annual meeting of the GICE by City Councilman, Glenn P. Clasen.

Mr. Moses, a consulting mechanical engineer, has written articles for Heating, Piping & Air Conditioning on the design of heating and air conditioning systems.

Succeeding Moses as president of the Gulf group is C. Carter Brown of Brown & Butler, consulting engineers. Other officers elected are Thomas C. Davis, first vice president; E. Carlton Guillot, Jr., second vice president; and Jack Perrault, secretary-treasurer.

CIVIC HONOR being bestowed upon Hueston M. Smith, (right) C.E.C. president, and Warren G. Moses, (left) GICE president and HPAC author. Making the presentation is New Orleans City Councilman, Glenn P. Clasen

Fully Automatic Post Office Has Medium Temperature Hot Water Heating System

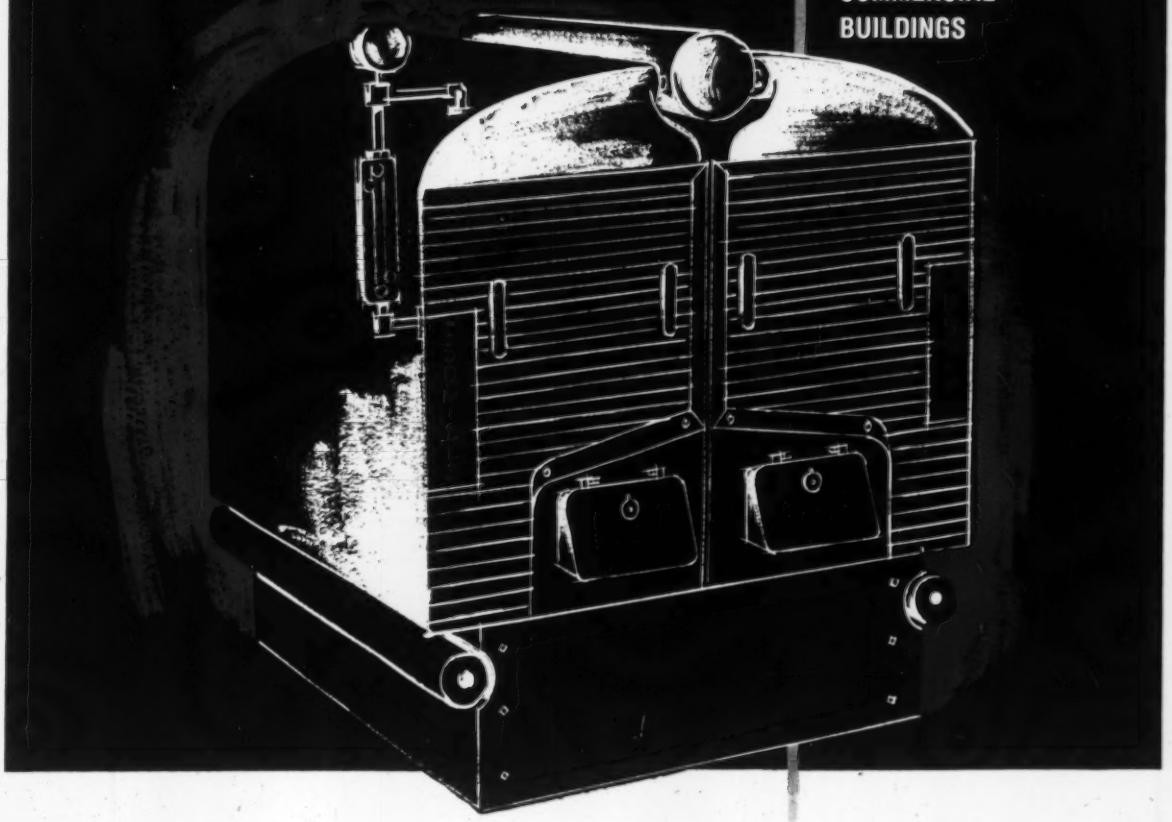
A POST OFFICE that uses electronic equipment to separate packages from letters, cancel stamps, and sort mail according to its destination has been built in Providence, R.I. It is considered to be the newest concept in rapid postal service.

The 300 x 420 ft building is heated by a central heating plant, located in an adjacent building used for trucks and the powerhouse. Two 500 hp boilers supply water at 230 to 245 F that is pumped to and from the post office building through a loop piping system. The return water is 180 to 200 F.

The central heating plant automatically handles a heating load estimated at 23 million Btu per hr, according to Cleaver-Brooks Co. Total area of the post office, including basement, heating plant, and truck dock is 214,000 sq ft.

Announcing...

A NEW OIL OR GAS FIRED, WATER TUBE BOILER FOR SCHOOLS, INSTITUTIONS, COMMERCIAL BUILDINGS



Mills '450'

The result of many years of engineering and testing, the new Mills '450' meets the high standard set by the H. B. Smith-Mills boilers over the years. Its unique features are now ready to help you solve your toughest boiler problems.

CHECK THESE MILLS '450' PERFORMANCE CHARACTERISTICS:

- Efficiency *over* 80%
- Stack temperature *under* 465°
- Draft loss *lowest* of any boiler in its class
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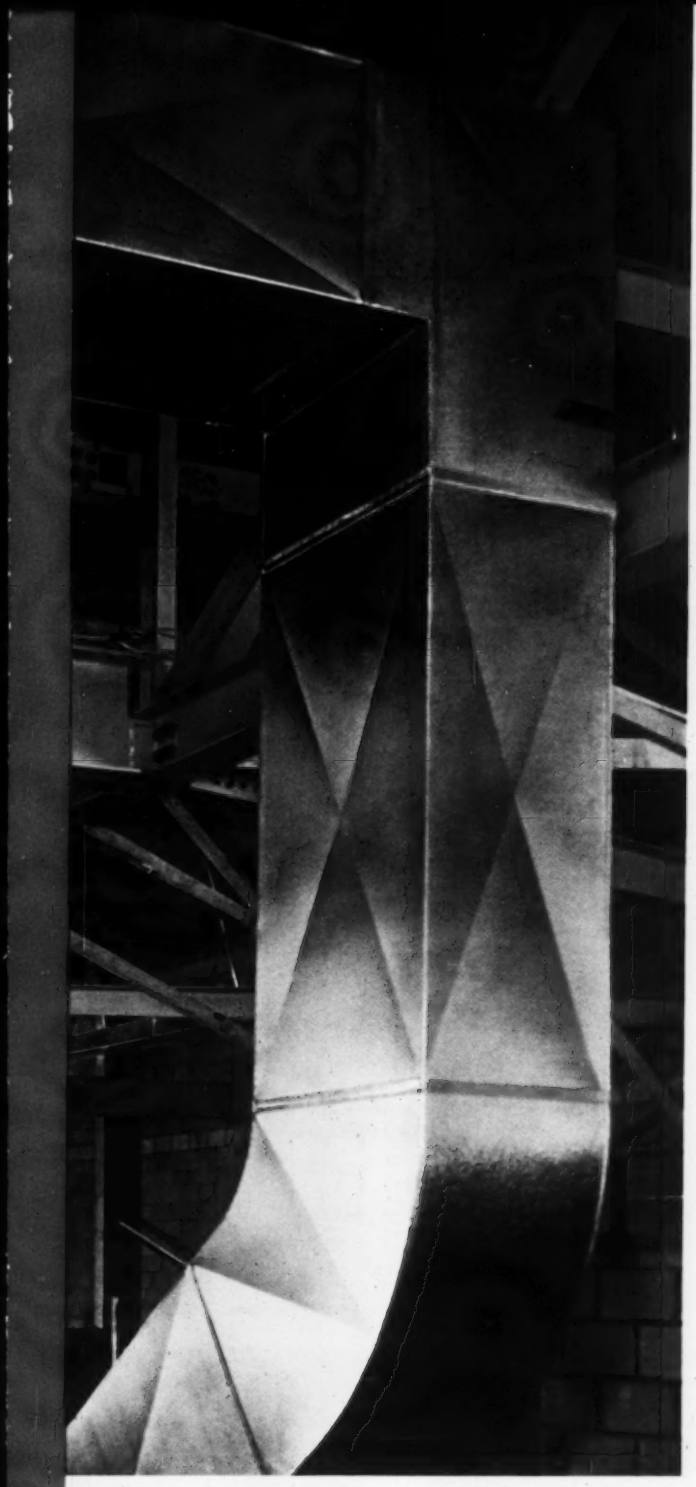
H.B. Smith CAST IRON BOILERS

H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS • Established 1853

Little Big Town

Young Men Gambling



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brand-new brand in hot dipped quality galvanized steel sheet

You can tell Youngstown **tufkote** by the bright new sparkle of its fine zinc coat. And durable **tufkote** performs as well as it looks. You can test it any way you want to prove its workability. Bend it to see how easily it forms. Draw it to watch its ductility.

tufkote comes from the newest, finest galvanizing line in the industry. The new 848-foot line at our Indiana Harbor plant incorporates every modern facility insuring zinc coated sheets in both cut lengths and coils, unequaled in superior quality.

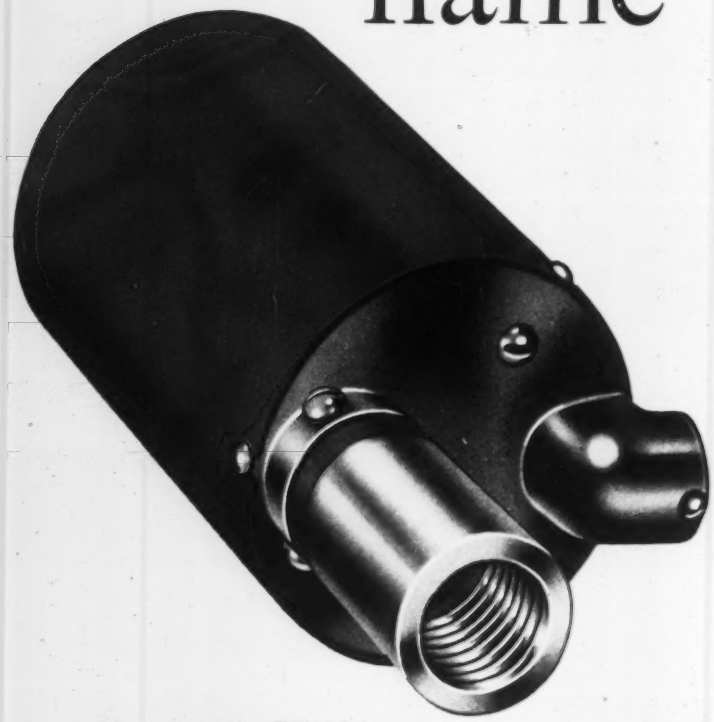
tufkote offers the best combination of strength and bendability. You'll never see formation of oxide or dross. No "spikes" or "icicles". Nor will it flake or peel when you use it. **tufkote** will pass your stiffest inspection because it is carefully watched from ore to open hearth and rolling and through the precision Sendzimir zinc coating process itself.

Specify new Youngstown **tufkote**. Get the exact coating, finish and adherence your specs call for. And you get fast, dependable service that makes Youngstown higher quality an even greater value.

Youngstown – growing force in steel

For full details on new **tufkote** galvanized sheet, write, Dept. 10-B
The Youngstown Sheet and Tube Company, Youngstown, Ohio

Senses only the flame

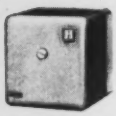


Honeywell's C7012A

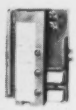
ULTRA-VISION* FLAME DETECTOR

No hot refractory hold-ins!

Satisfy every flame safeguard need with a quality Honeywell control or system



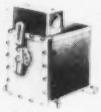
RA890 Protectorelay*



R478 Programming Relay

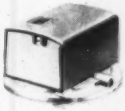
V4034 Fluid Power Gas Valve

L404 Pressuretrol*



M931 Modutrol* Motor

V4021 Oil Valve



C645 Pressure Switch

V4004 Diaphragm Gas Valve

For details, write Minneapolis-Honeywell, Dept. AC-4-46, Minneapolis 8, Minnesota

Honeywell

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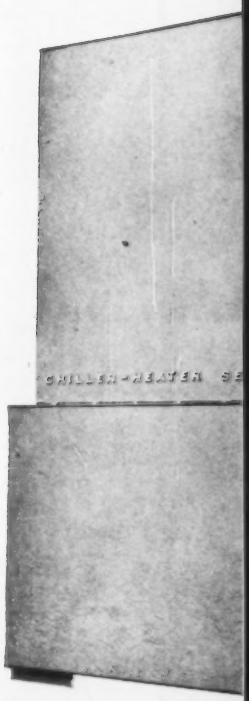
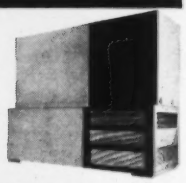
THE GAS INDUSTRY ANNOUNCES...



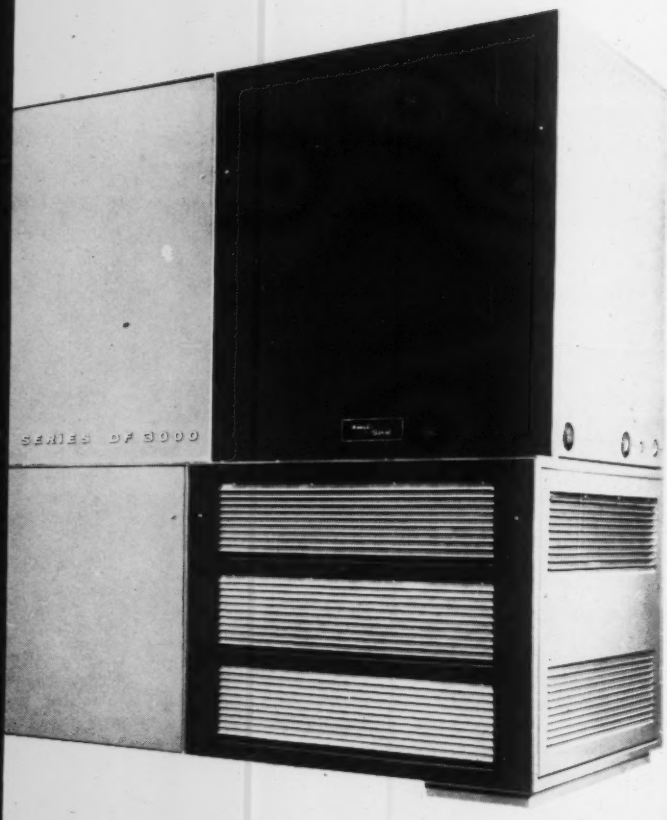
A MAJOR BREAKTHROUGH IN COOLING & HEATING

ARKLA'S NEW 25-TON GAS CHILLER-HEATER



Here it is – the revolutionary new Arkla absorption unit that heats and cools without a steam producing boiler or converter. Gas-fired burners in the generator section energize the system for absorption cooling, or for heating. It's the perfect system for modern year 'round gas air conditioning.

INSTANTLY HEATS AND COOLS AUTOMATICALLY ◀ HEATS WATER WITHOUT A BOILER ◀ COOLS WATER WITHOUT A COMPRESSOR ◀ REQUIRES NO LUBRICATION ◀ SEALED FOR LIFE, REQUIRING MINIMUM MAINTENANCE ◀ MAINTAINS SAME CAPACITY FOR THE LIFE OF THE UNIT ◀ HAS NO MOVING PARTS IN THE HEATING AND COOLING CYCLE ◀ FIRST MEDIUM OR LARGE TONNAGE AIR CONDITIONER THAT HEATS.

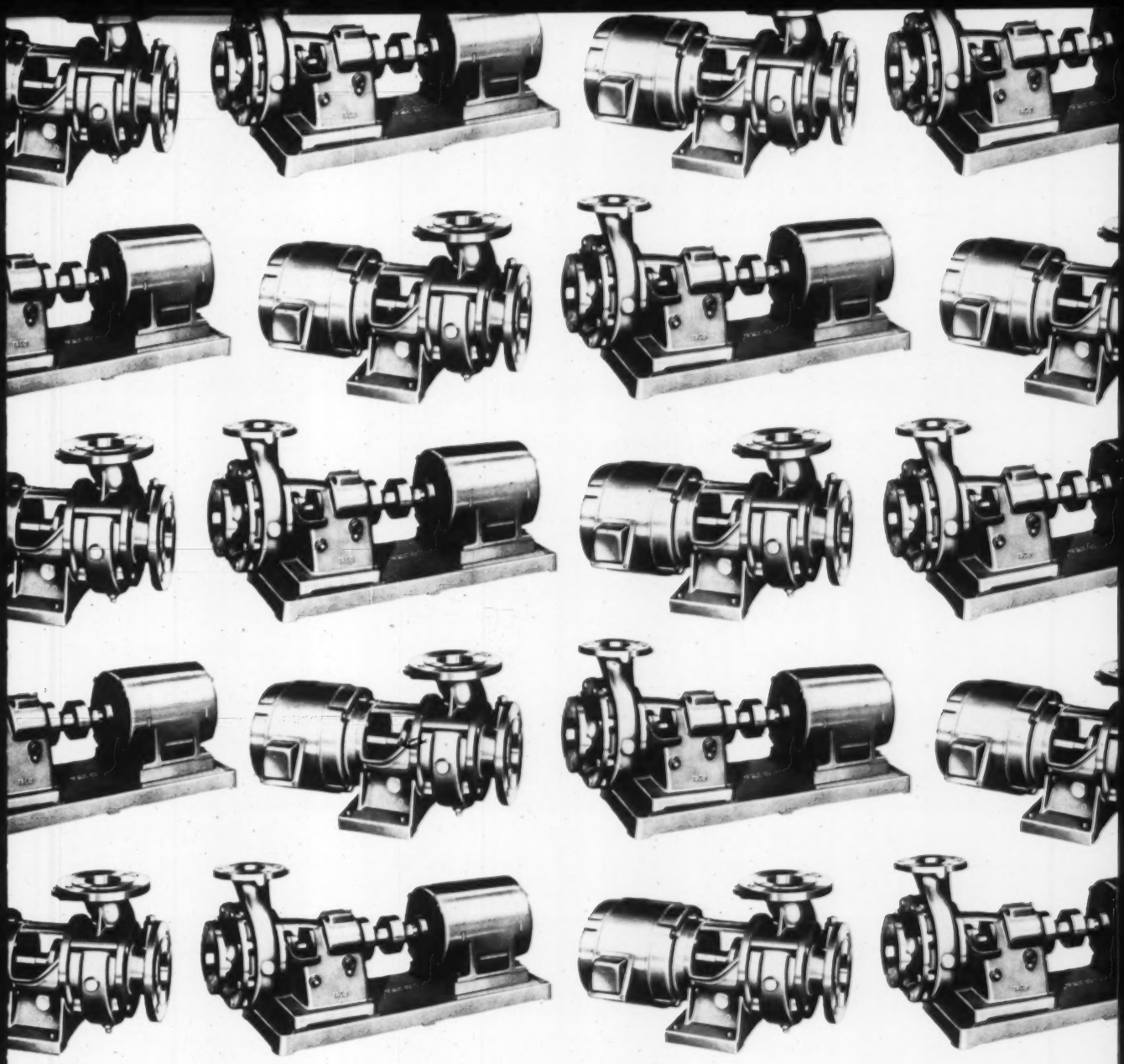


Truly revolutionary... investigate for your next building project the new Arkla DF-3000 Gas-Fired All Year® Chiller-Heater.

For details contact your local Gas Company. Or write Arkla Air Conditioning Corporation, 812 Main Street, Little Rock, Arkansas.

American Gas Association

FOR HEATING & COOLING GAS IS GOOD BUSINESS!



TACO Stocks your Custom-Built Pumps!

That's right. By specifying any *standard* TACO "LP" pump, with its many options, you can actually order a custom-designed, single stage centrifugal pump to precisely meet your requirements!

For Hospital applications, for example, specify any standard "LP" with sleeve bearings and quiet motor. For industrial applications merely specify the *same* "LP" with ball bearings and a regular motor.

And, just as easily, you can specify an "LP", base-mounted or close-coupled . . . with mechanical seals or stuffing boxes, with or without cooling jackets . . . shafts or shaft sleeves in stainless steel and so on. What's more, every "LP" provides many extras, such as advanced design throttle bushing, oil slinger ring lubrication, center-line discharge and many more. Get complete specifications . . . specify "LP". All products in the broad TACO line are "efficiency engineered" to provide maximum performance and economy on all your installations. Write TACO HEATERS, INCORPORATED, 1160 Cranston Street, Cranston 9, R. I.

Taco

EFFICIENCY ENGINEERED PRODUCTS

All the air problems of this solved with *one system*

Unique requirements of Montana State structure point up AAF's capability for complete air engineering

WHEN you decide to house the departments of Zoology, Wild Life, Microbiology, Bacteriology and Public Health in one building, you know that some special and unusual air problems must be solved.

The air in Montana State's Health Sciences Building had to be cleaned, cooled, heated and moved—all in varying degrees to meet the special needs of animal environment and isolation rooms, surgery rooms, sterile transfer rooms and research labs.

The job called for many different types of component equipment plus the knowledge and experience to coordinate its functioning into one custom-engineered system. The building planners turned to AAF—the one company that provides all the major components for an engineered air system. Result: one system of completely conditioned air . . . one responsibility for its performance.

Booklet 518 describes the complete line of AAF component products. For a free copy, address Mr. Richard Smith, American Air Filter Company, Inc., 373 Central Avenue, Louisville, Kentucky.

American Air Filter

BETTER AIR IS OUR BUSINESS

AIR CLEANING: (Atmospheric Dust) AAF electronic air cleaners, viscous impingement filters, *dry-type filters,* engine & compressor filters. (Process Dust) electrostatic precipitators, wet-type collectors, dry-type collectors, fabric arresters. AIR CONDITIONING, HEATING & VENTILATING: Herman Nelson *air conditioning unit ventilators,* unit ventilators, portable heaters; Kennard/Nelson dual-duct air conditioning units, *multi-zone air conditioning units,* packaged central station air handling units, sprayed-coil dehumidifiers, *fan-coil units, packaged liquid chillers, cooling towers,* evaporative condensers, direct-expansion coils, water coils, steam coils, unit blowers, industrial exhausters, centrifugal fans, unit heaters, radiation products; Illinois traps, valves, specialties, heating systems and controls.

● *Italics denote products used in Health Sciences Building*

HEALTH SCIENCES BUILDING, Montana State University, Missoula, Montana. Architects & Engineers: Witwer & Price, Missoula; Structural Engineers: Lyerla & Peden, Spokane, Washington; Electrical Engineers: James F. Parr, Hamilton, Montana; Mechanical Contractor: Reber Plumbing & Heating, Helena, Montana.

university building from *one source...*

AAF

AIR CLEANING PRODUCTS
Air Filters
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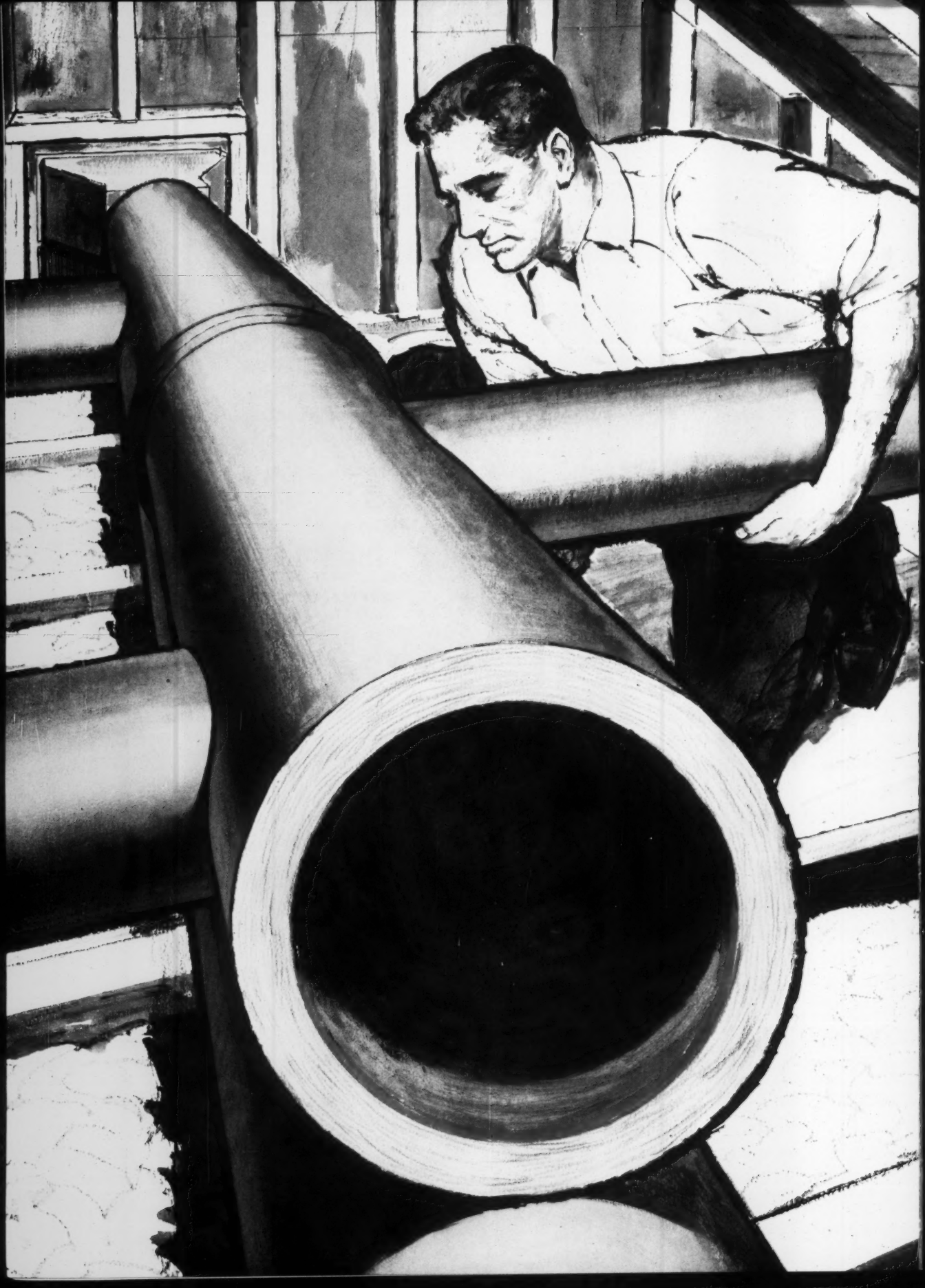
AIR CONDITIONING, HEATING & VENTILATING PRODUCTS

COMPLETELY CONDITIONED AIR



Announcing

Armstrong ARMAGLAS DUCT

a prefabricated duct system for residential and commercial heating and air conditioning

ALL-IN-ONE ARMAGLAS DUCT combines dual temperature air duct, thermal insulation, vapor barrier, and sound absorber in one ready-to-install material.

EFFICIENT AIR DUCT: Armaglas Duct is a round, prefabricated, dual temperature duct that can replace insulated sheet metal duct at equal or lower cost. Round Armaglas Duct handles air efficiently with friction losses practically the same as circular metal duct.

UNIFORM AND PERMANENT THERMAL INSULATION: Armaglas Duct is preformed at the factory of fine glass fibers, bonded together into a strong tube of thermal insulation that is uniform and permanent in density and thickness. The glass fibers are non-corrosive, non-irritating, and completely resistant to air erosion.

VAPOR BARRIER: The aluminum pigmented plastic surface of Armaglas Duct forms an effective built-in vapor barrier. It is highly resistant to puncture and deterioration. It won't rot, corrode, or mildew.

SOUND ABSORBER: The glass fiber interior of Armaglas Duct readily absorbs airborne fan and compressor noises. And because it is non-metallic, Armaglas Duct eliminates the annoying "booming" or "canning" that occurs when metal systems expand or contract.

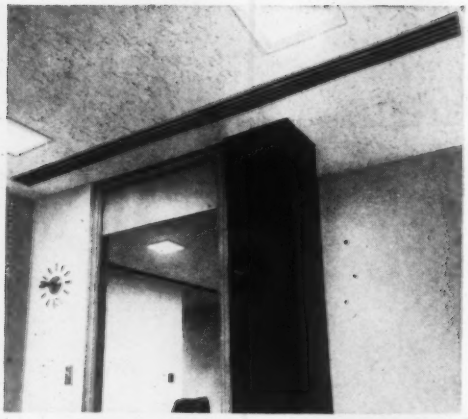
READY TO INSTALL: Armaglas Duct comes ready to install. There's no time lost in preassembly—no folding or other preparation required with sheet metal. The six-foot sections are remarkably fast and easy to install. They can be cut with an ordinary knife and joined with simple sheet metal sleeve connectors. Forming elbows and other fabrications is fast and easy, too, and all joints are sealed with pressure-sensitive tape.

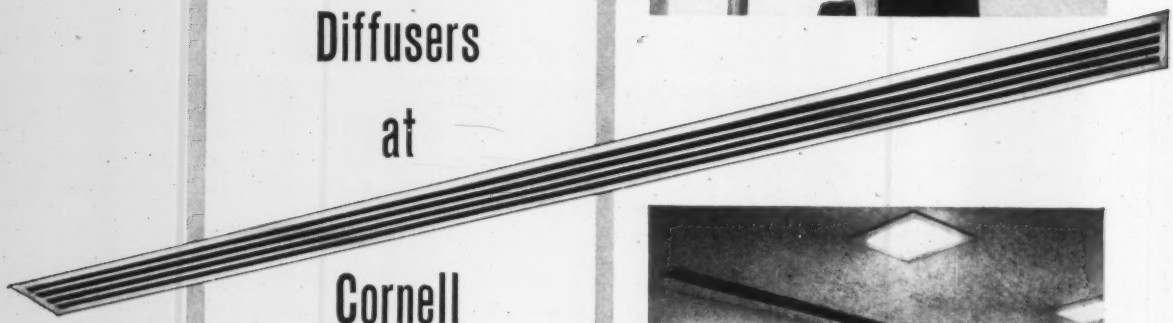
When the system is assembled, the job is done. The separate step normally required to insulate sheet metal duct is eliminated. The insulation is built in with modern, efficient Armaglas Duct.

For a free booklet with complete information on Armaglas Duct, write Armstrong Cork Company, 4404 Sherman St., Lancaster, Pennsylvania.

Armstrong ARMAGLAS DUCT

New Anemostat Architectural Straight Line Diffusers at Cornell University





Here is the new Anemostat ASL Architectural Straight Line Air Diffuser installed in the Willard Straight Hall of Cornell University at Ithaca, New York. This new ASL unit for ceiling or wall application combines the superior air diffusion characteristics of all Anemostat air diffusers with the esthetic appearance of a slender unit with symmetrical vanes. The ASL diffusers are easy to install; no screws, nuts or bolts are needed.

Write for Anemostat Catalog ASL-70

ANEMOSTAT®

ANEMOSTAT CORPORATION OF AMERICA

10 East 39th Street, New York 16, N. Y.

Representatives in Principal Cities

ARCHITECT:
M. V. Perrault, the College of Architecture, Cornell University

ENGINEER:
Leigh St. John Associates, Binghamton, New York

CONTRACTOR:
A. Friederich and Sons Company, Rochester, New York

AC1979

Union Pacific headquarters building, Omaha, Neb. Air Conditioning installation by Natkin & Co. Omaha

After taming 24 summers, Union Pacific replaces its air conditioning with more Chrysler Chillers

Shown above is the 12-story headquarters of Union Pacific Railroad, in Omaha, Nebraska. Since 1937, chilled water for its 850 tons of air conditioning has been supplied by Chrysler Liquid Chillers. This equipment has served through 24 simmering midwest summers without a single major difficulty.

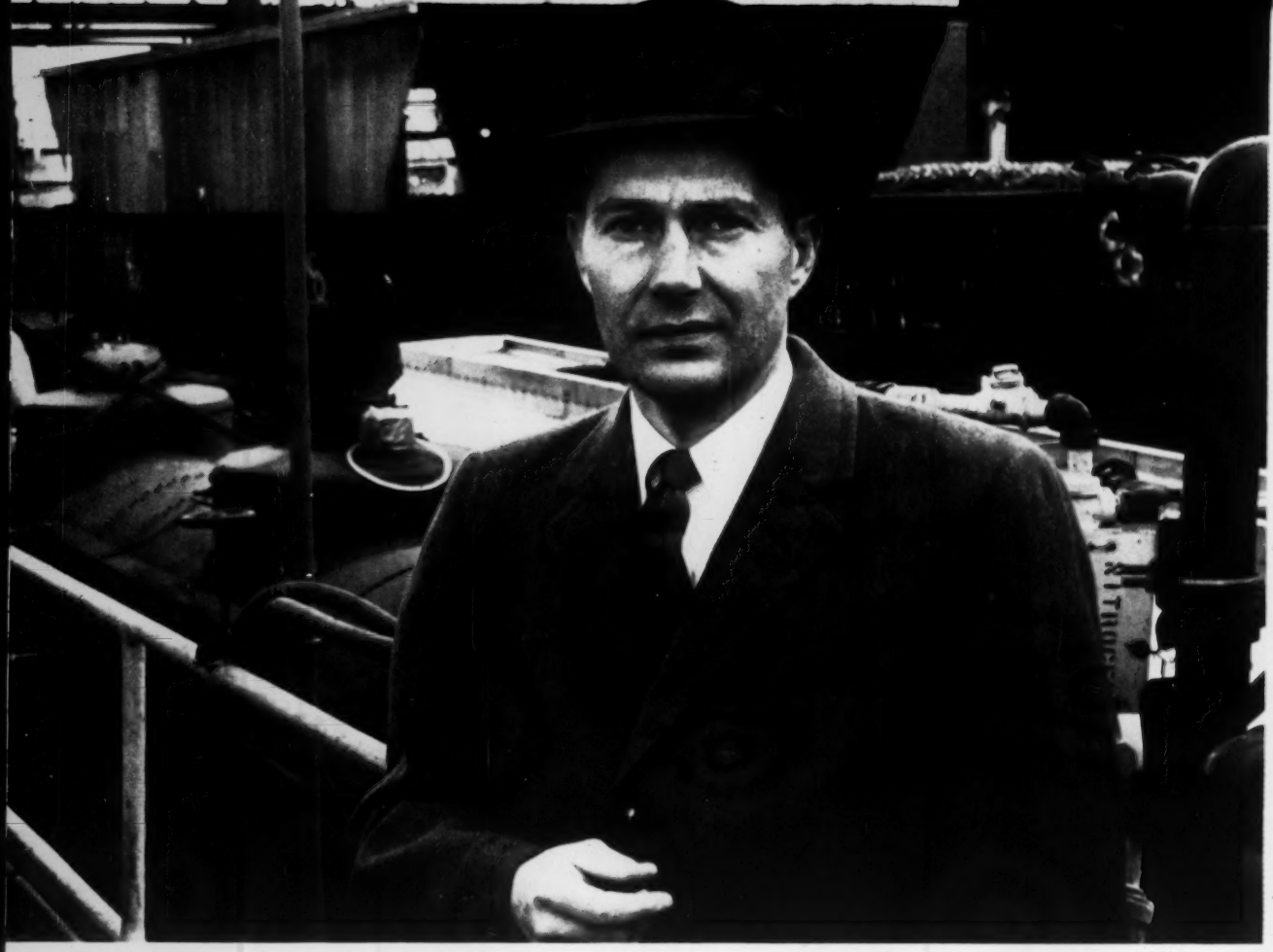
So satisfied was Union Pacific that, when the time finally came to install new equipment, the company again specified Chrysler. Twelve new Chrysler Chillers—modern versions of the equipment that performed so satisfactorily—were ordered. Hooked in parallel, these units permit efficient zone and area cooling for every section of the building.

Chrysler packaged liquid chillers are rugged, light-weight and quiet. They run so smoothly they don't have to be bolted to the floor. And they don't require any special foundation.

Extra-long service life, with minimum maintenance, is a familiar story to owners of Chrysler Air Conditioning. But there's much more to the Chrysler product story. For complete data, or the technical cooperation of a Chrysler Engineer, write today.

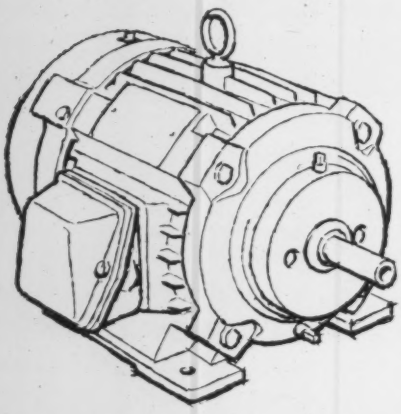
CHRYSLER AIRTEMP

Chrysler Corporation, Airtemp Division, Dept. CD-41 Dayton 4, Ohio



M. K. Sieber, Sales Engineer, Charleston, W. Va. District Office, Reliance Electric & Engineering Company.

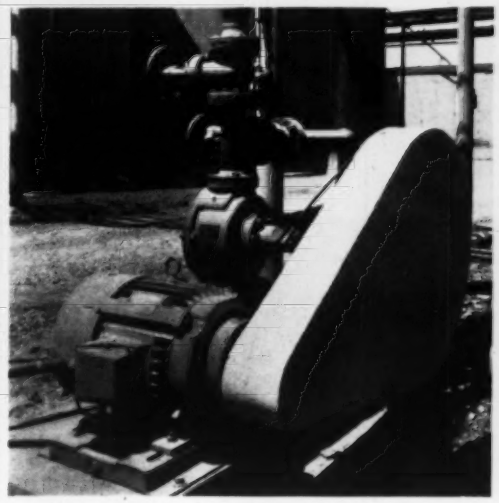
"Duty Master can handle the meanest motor job you can name.

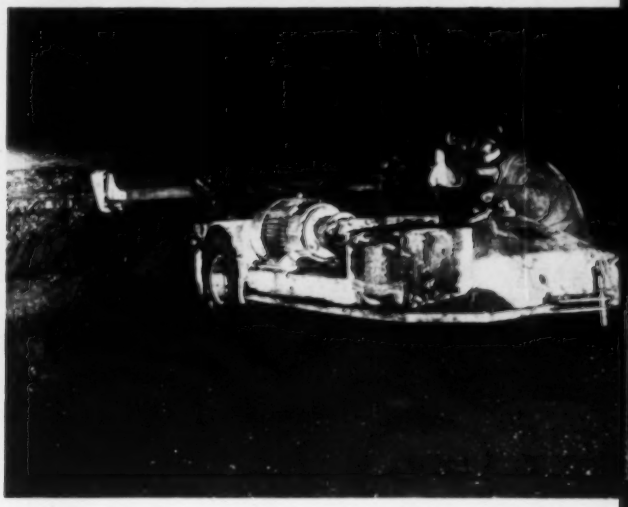


"Every possible safeguard has been built into these totally-protected Duty Masters. They actually exceed the rigid specifications set up to protect users from corrosion, explosion, dirt or violent weather.

"In my territory, motor protection like this is pretty important, and Duty Master is living up to its reputation as a really rugged motor."

RELIANCE Duty Master A-C. MOTOR





The combination of Duty Master's protective design, engineering and construction gives you plenty of reasons why these motors perform so consistently well at peak loads.

The explosion-proof Duty Master, for example, meets the qualifications of Class I, Group C and D; Class II, Groups E, F and G in hazardous locations as defined by the National Electrical Code . . . actually exceeds requirements of Underwriters Laboratories—and it's corrosion-proof as well!

Specifically, Corrosion-proof Duty Masters are immune to acids, alkalis and solvents . . . Weather-proof motors resist rain, sleet, snow and wind-blown dust. The Dust-proof Duty Master, being strictly what the name implies, even is guarded against highly magnetic, abrasive taconite dust.

The vital factor to be recognized is Duty Master's *protection from the inside out* . . . in stator windings, rotor and bearing system. Insulation, as well as enclosure, is impervious to oil, water, acids, chemicals, dust and dirt. The lubrication system employs the famous Reliance "Metermatic", feeding precise amounts of grease to double-shielded bearings. It is impossible to under-grease or over-grease Duty Master.

In coal mines and chemical plants . . . in extremes of weather or damaging dust, Duty Master tackles the toughest jobs. Your nearest Reliance Sales Engineer will give you all the technical proof you need. Call him, or if you prefer, write for full information.

B-1656

Product of the combined resources of Reliance Electric and Engineering Company and its Master and Reeves Divisions

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 364A, CLEVELAND 17, OHIO
Canadian Division: Toronto, Ontario
Sales Offices and Distributors in Principal Cities

Duty Master A-c. Motors, Master Gearmotors, Reeves Drives, V★S Drives, Super 'T' D-c. Motors, Generators, Controls and Engineered Drive Systems.

52 FLOORS OF PERSONALIZED COMFORT

Johnson Control a Highlight in New Union Carbide Building

One of the nation's most exciting and modern structures, the Union Carbide Building contains over 1.1 million square feet of rentable floor space. Its air conditioning equipment includes a high-velocity conduit system with 6,000 perimeter induction units and, for the interior, a high-pressure dual-duct system with 54 central fan systems.

Throughout this pace-setting skyscraper, a specially planned Johnson Pneumatic Control System maintains an ideal climate for business efficiency. Some 4,000 thermostats, 4,000 control valves, and related controls were installed to assure personalized, air conditioned comfort at all times!

Shown above is one of two Johnson Pneumatic Control Centers located in the basement and one of the top floor offices. Their features include: continuous indication of room temperatures, air and water temperatures, and pressures at over 450 control points; remote adjustment of all systems; optional recording of any point shown; and schematic diagrams of all systems and their controls, plus a push-button viewer with zoned floor plans of each floor in the building.

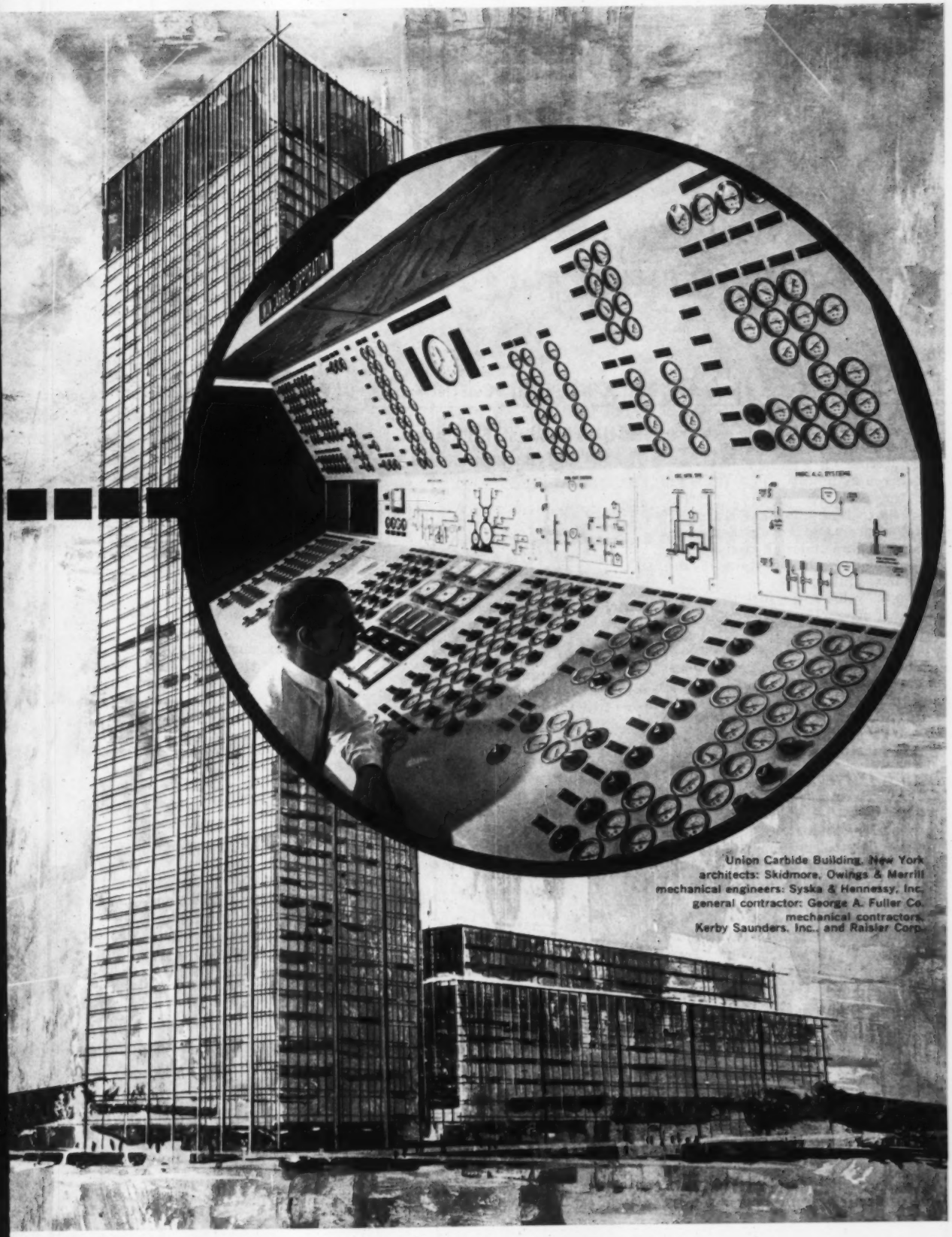
Engineered for economy as well as for comfort, the Johnson System makes possible major time and operational savings. With the aid of the control centers, for example, the number of man-hours required to supervise and control the vast network of primary air conditioning equipment is reduced to a minimum.

The specialized Johnson organization can help provide any building, small or large, with comparable efficiency and savings. Ask your Johnson representative to explain how the unmatched performance and lifetime economy features of Johnson Pneumatic Control can be applied to your clients' buildings. Johnson Service Company, Milwaukee 1, Wisconsin. 105 Direct Branch Offices.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885



Union Carbide Building, New York
architects: Skidmore, Owings & Merrill
mechanical engineers: Syska & Hennessy, Inc.
general contractor: George A. Fuller Co.
mechanical contractors:
Kerby Saunders, Inc., and Raisler Corp.

DON'T COMPARE

insul-fil®

WITH ANY OTHER FILL-TYPE INSULATION!

insul-fil Is A Reinforced Hydrocarbon Fill

There's a big difference — a tremendous difference between Insul-Fil and all other fill-type insulations for underground piping. Only Insul-Fil has the exclusive patented Perlite filler that eliminates flow. Insul-Fil installations have proven themselves by standing up under all kinds of conditions where other fill-type insulations have failed.

It is a well known fact that bitumens will flow when subjected to heat or pressure. Even hard bitumens which do not flow will crack when cool.

But Insul-Fil, with its Perlite filler, is completely different and infinitely more efficient in thermal stability and insulation values. It provides greater structural stability even when used at maximum temperatures.

Perlite Aggregate In Insul-Fil Makes All The Difference

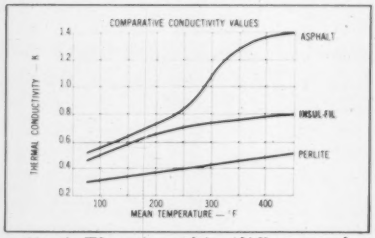
A unique combination of high softening point petroleum asphalt blended with coated inorganic Perlite, Insul-Fil provides far greater insulation value than any unfilled asphalt. Perlite, made from a volcanic rock which has been crushed, screened and expanded at a very high temperature, is composed of glass-like beads or perls. Each perl contains a maze of "sealed" dead air cells which give Insul-Fil its light density and high insulation value. The patented process, developed for waterproofing the Perlite, makes Insul-Fil far superior in water resistance. In addition, another exclusive Insul-Fil development is priming of pipe with accelerator #7591, which provides continuous adhesion of Insul-Fil to pipe, speeds consolidation, and gives positive protection against corrosion by galvanic action.

INSUL-FIL Most Effective Of All Fill-Type Insulations For Underground Piping

Field installations and all types of conclusive testing prove Insul-Fil by far more effective in insulation values.

After Insul-Fil is installed and heat is introduced into the lines, the Insul-Fil is formed into a homogeneous consolidated mass consisting of a small plastic area of varying thickness at the pipe wall, an accompanying sintered area, and in the lower temperature range an area of unsintered material immediately adjacent to the soil.

Unlike the 100% asphalts, Insul-Fil does not crack and craze from thermal shock when the heat is turned on or off and therefore does not provide access for water to the pipe. It is during the critical shut down period of spring and summer when cold pipe is especially subject to corrosion that Insul-Fil is so highly water resistant.



Yes! There's a big difference between Insul-Fil and all other fill-type insulations for underground piping.

INSUL-FIL Most Economical Of All Fill-Type Insulations For Underground Piping

1 — Comparative cost analysis between Insul-Fil and other types of underground conduit proves Insul-Fil in place costs substantially less.

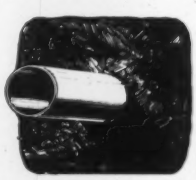
2 — Insul-Fil weighs 30% less than other materials, and therefore costs less to ship, less to handle, less to install.

3 — Insul-Fil is simple to install. The materials are all in one package — 2 cubic feet weighing approx. 57 lbs. Insul-Fil Primer supplied free of cost is applied to the surface of the pipe. The loose Insul-Fil is poured from the bag around the piping to be insulated, well prodded and tamped, then the trench is backfilled. As simple as that. Heat introduced into the system forms the conduit. Thus labor for installing Insul-Fil requires no special skill. The application is a simple, one trade operation.

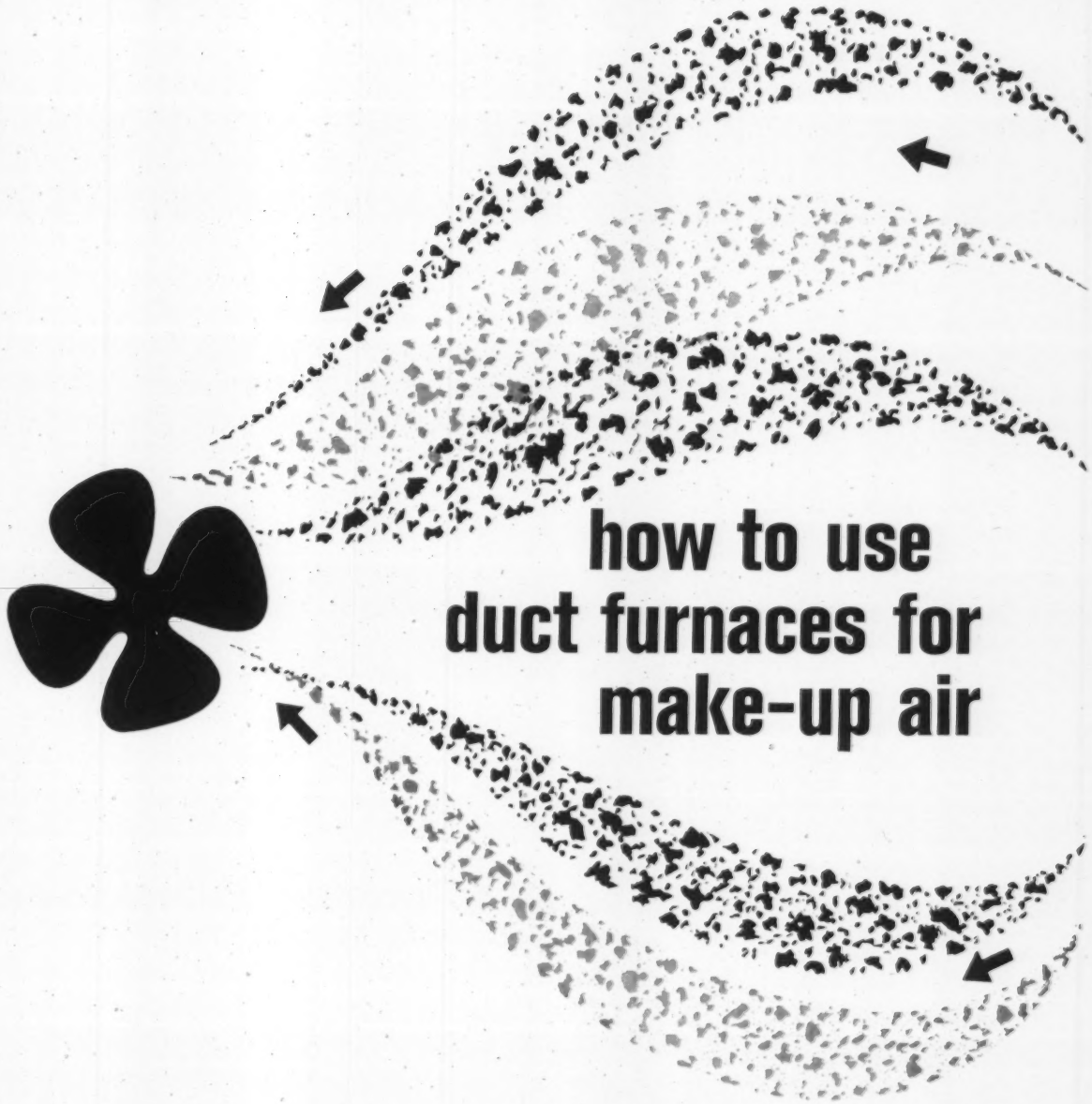
Insul-Fil keeps on saving you money, with its effective control of heat loss and pipe corrosion, eliminating maintenance. Field changes in the installation of Insul-Fil underground systems can be made easily, without changes in the material or its application.

Yes! There's a big difference between Insul-Fil and all other fill-type insulations for underground piping.

FREE: 40-page Technical Data Book, complete with engineering heat loss curves, drawings, and installation specifications.



insul-fil COMPANY, INC.
DIVISION OF: **MIRACLE ADHESIVES CORPORATION**
250 PETTIT AVENUE, BELLMORE, LONG ISLAND, N.Y.



how to use duct furnaces for make-up air

Free from Reznor: Learn about this profitable use of duct furnaces along with other valuable information on make-up air in our just published handbook "What to Consider in Designing Make-Up Air Systems."

Manufacturing plants, chemical, food and material processors, restaurants, bakeries and dry cleaners are becoming increasingly aware of the need for make-up air. They now realize that bringing in clean, heated replacement air through a duct furnace can prevent undesirable drafts and the infiltration of dust, dirt and fumes.

Reznor's handbook on make-up air is one of a new series of Reznor Heating Handbooks to help you solve commercial and industrial heating problems. For your copy, published by the world's largest manufacturer of gas unit heaters, fill in the coupon and mail to Reznor. Or, for more information, call your Reznor distributor or nearby Reznor district office listed in the Yellow Pages under "Heaters—Unit."

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Send me a copy of "What to Consider in Designing Make-Up Air Systems."

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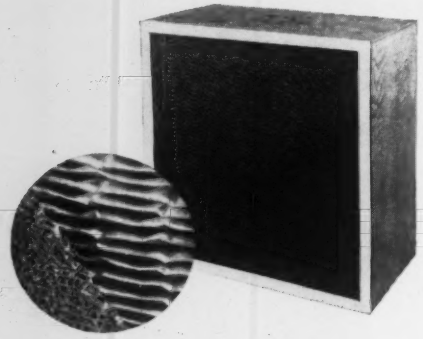
Mine Safety Appliances Company

201 North Braddock Avenue, Pittsburgh 8, Pennsylvania

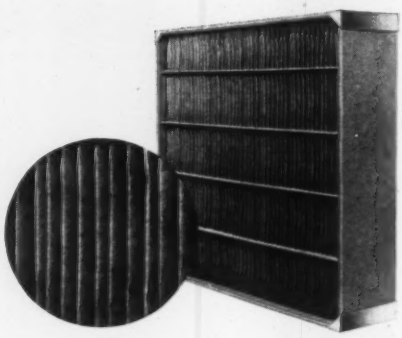
MSA:

Fluid Purification Equipment / Fluid Purification Specialists for 45 years



M-S-A® UltraAire* Space Filter

Lightweight, fire-resistant, unusually strong, and ideal for high humidity service. Individually pretested and proved at least 99.97% efficient in removing particles of 0.3 micron diameter.

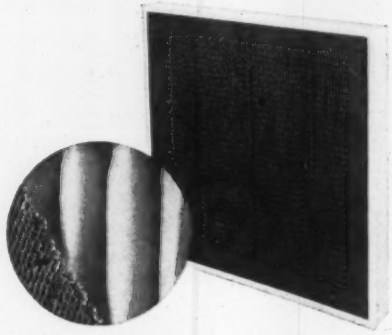


M-S-A® Dustfoe* Space Filter

Offers the efficiency of an Electrostatic Precipitator without the high cost and without the possibility of arcing "blow-off." 85-95% certified efficiency on NBS Atmospheric Air Dust Stain Rating.

M-S-A® Cylindrical-Type UltraAire* Space Filter

Honeycomb-type fold without separators is admirably suited to cylindrical element construction. This shape is preferred for pressure systems and round ducts. Easy to handle. Inexpensive to ship.



M-S-A® Air-O-Kay* PreFilter

Impingement type panel prefilter which can be used oiled or dry to remove lint and other large airborne particles from the atmosphere. 60-70% certified efficiency on NBS Stain Rating.

*Trademark

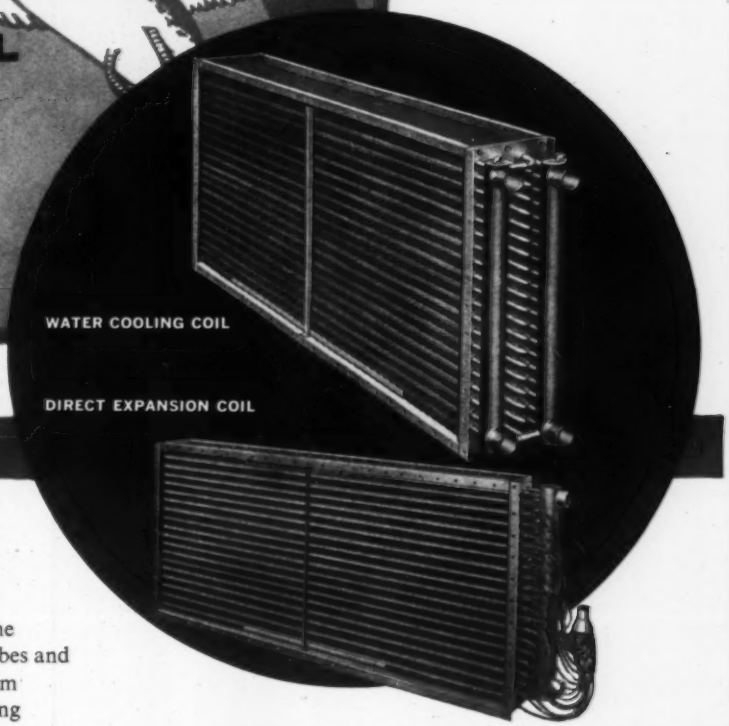
Write for illustrated technical bulletins on M-S-A Space Filters related to your particular system problem. Ask an MSA Representative for system recommendations. Mine Safety Appliances Company, Pittsburgh 8, Pa., Phone: CHurchill 1-5900.

Other Fluid Purification Equipment includes catalytic filters for jet aircraft cabin air; air separation plants; inert gas generators; space capsules; bomb shelters; air line filters; jet fuel and hydraulic fluid purification.

HI PERFORMANCE EFFICIENCY

with the new
TYPE "5" COIL

any size
any style
any material
for water, steam, direct expansion or special fluids



McQuay Means Quality

The new McQuay Type "5" coil design offers you a new high in fin efficiency by attaining the highest heat transfer rate possible without excessive air friction. The combination of equilaterally staggered tubes and modified rippled fins produces a maximum of air turbulence to interrupt the insulating boundary layer film and still retain the intimate and prolonged contact between air and the heat exchanger surface.

Each Type "5" coil features practically an unlimited flexibility in selection of coils to more accurately meet load requirements. Standard coils are furnished with copper headers and flow-controlled circuiting to assure the turbulent fluid flow necessary without using restrictive internal devices.

For any coil requirement, look to McQuay. Call your local McQuay representative or write to McQuay Inc., 1601 Broadway N. E., Minneapolis 13, Minnesota.

THE NATION'S LARGEST COIL MANUFACTURER

SELECT McQUAY STANDARD COILS FROM ANY COMBINATION OF THE FOLLOWING:

Single Serpentine . . . . . One to 14 fins per inch
Half Serpentine . . . . . From 6" through 36" high face
Double Serpentine. . . From 6" through 144" nominal tube length

ALSO AVAILABLE IN SPECIAL CIRCUITS, FIN SPACINGS, SIZES AND MATERIALS

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

"Here's why I'm switching to H&M central system air conditioners

. . . I can get just the fin spacing, tonnage and CFM I want."

Now, Halstead & Mitchell gives you a choice of 6, 7, 8 or 10 fins per inch . . . makes it much easier to match a central fan-coil unit to a particular job or to meet specifications.

And look what else H&M offers: a selection of three coil face areas for each model; direct expansion or chilled water cooling coils (1 to 8 rows); hot water, standard steam or non-freeze steam heating coils (1 or 2 rows); cooling capacities of 3 to 92 nominal tons with 880 to 47,750 CFM; Turbu-Flo coils arranged for right or left-hand connections; horizontal or vertical mounting for discharge in any direction . . . and every accessory item you need to simplify your installation.

Why don't you check H&M Central System Air Conditioners? Call your wholesaler or write for Bulletin AHU-100. Halstead & Mitchell Co., Dept. C-4, Bessemer Bldg., Pittsburgh 22, Pa.

Central System Air Conditioners · Air-Cooled Condensers · Cooling Towers · Water-Cooled Condensers

AH SERIES
AIR HANDLER

HM
Halstead & Mitchell

3 good reasons for specifying the NEW

Fairbanks Morse SPLIT CASE PUMP

1

CASING WEARING RINGS:

Maintain high pump efficiency, minimize recirculation past the impeller rim; rings easily replaced when waterborne particles cause wear.

2

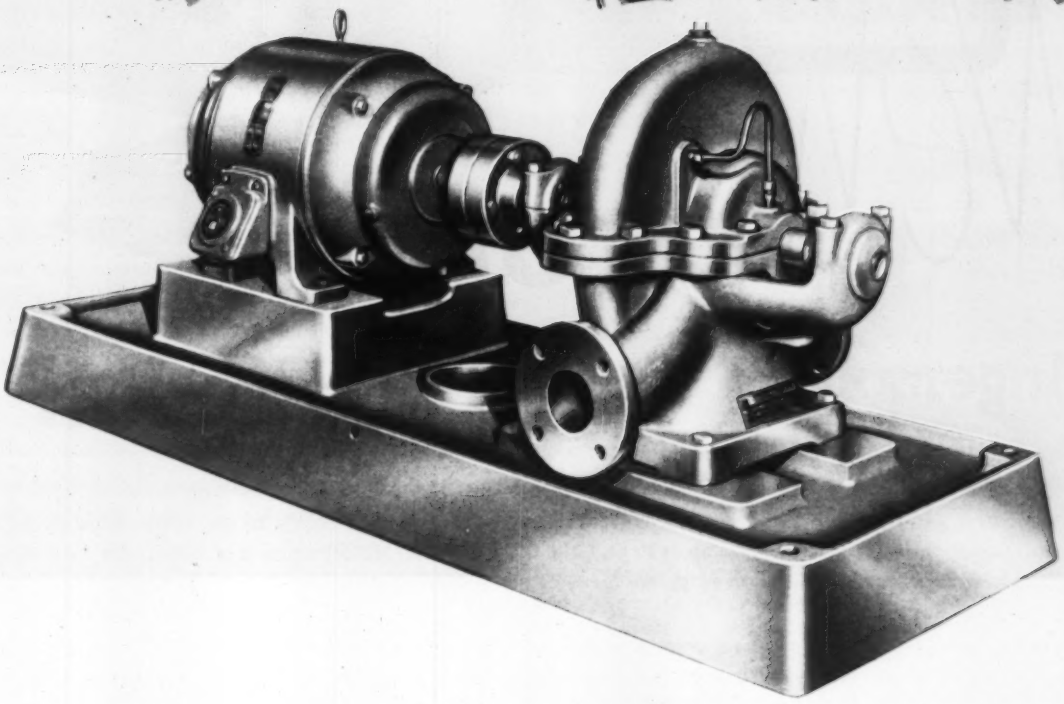
MAINTENANCE-FREE OPERATION:

Sealed pre-lubricated bearings require no checking, no lubrication service.

3

SHAFT SEALS OR PACKING:

Optional construction, factory supplied or field conversion, to suit pumping requirements, either mechanical shaft seals or conventional ring-type packing.



A brand new design . . . a brand new simplified concept in Split-Case Pumps. By far, your best buy. Single stage, horizontal Split-Case Centrifugal Pumps—a wise choice for chilled water, circulating or booster duty —cooling towers or general water supply, designed and supplied to you at moderate cost. For further information and factual bulletin #5820, write: **Pump & Hydraulic Div.; Fairbanks, Morse & Co.; Kansas City, Kan.**

FAIRBANKS MORSE

A MAJOR INDUSTRIAL COMPONENT OF

FAIRBANKS WHITNEY

HOSPITAL ZONE

for whisper-quiet air conditioning or heating service

QUIET

New 1750K

Ingersoll-Rand MOTORPUMP

Here is a pump that gives you extremely quiet operation without a sacrifice in efficiency and still has all the proven features of other Ingersoll-Rand high speed, high efficiency Motorpumps!

These packaged units with non-overloading motors are available in 3/4 through 7 1/2 horsepower sizes for deliveries to 500 gallons per minute and heads to 110 feet. Select a pump to suit your conditions, take it off-the-shelf, hook it up and you're ready to go. Other high speed "K" line Motorpumps are available through 25 horsepower.

Check these ruggedly constructed "K" line Motorpumps in either 1750 or 3450 rpm speed. Note their features and see why they deliver continuous, trouble-free service. You will save time and trouble by using "K" line Motorpumps.

over a century IR *of pump progress*

from the leading manufacturer . . .

Ingersoll-Rand

Merchandising Division
11 Broadway, New York 4, N.Y.

Write for complete data on all Ingersoll-Rand pumps for air conditioning service . . . the complete Motorpump line, cradle-mounted pumps and horizontally-split pumps.

199A9

In the busy months ahead...

INSIST ON

genetron®

SUPER-DRY REFRIGERANTS

...and be sure of the best!

General Chemical's advanced manufacturing techniques have helped bring new quality standards . . . new highs of purity and dryness for refrigerants. "Genetron" refrigerants are approved...accepted...and *preferred* as original charge and replacement in all types of modern refrigeration equipment.

See your wholesaler before the rush starts . . . make sure you're covered for all your refrigerant needs in the hurry months ahead. Be sure, also, to see the new "Genetron" Kit for field testing hermetic burnouts and the new pressurized "Genetron" 11 solvent cylinders for cleaning out mildly contaminated jobs; your "Genetron" wholesaler can tell you about this new "Genetron" service while you are there.

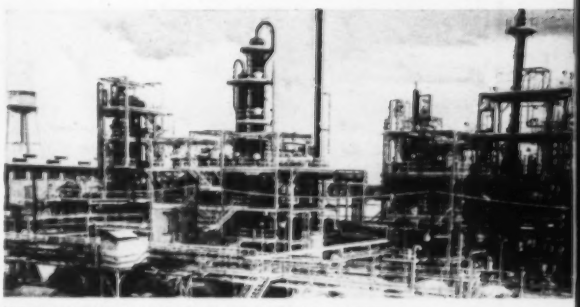
genetron 11 CCl_3F ORANGE LABEL TRICHLOROMONOFLUOROMETHANE

genetron 12 CCl_2F_2 WHITE LABEL DICHLORODIFLUOROMETHANE

genetron 22 $CHClF_2$ GREEN LABEL MONOCHLORODIFLUOROMETHANE

genetron 113 $C_2Cl_3F_3$ PURPLE LABEL TRICHLOROTRIFLUOROETHANE

genetron 114 $C_2Cl_2F_4$ BLUE LABEL DICHLOROTETRAFLUOROETHANE



"GENETRON" PRODUCTION CENTER

"Genetron" Super-Dry Refrigerants are produced in this giant fluorochemical center in Baton Rouge, La. . . . in Danville, Illinois . . . and will also soon be produced on the East Coast at a new plant now under construction at Elizabeth, N.J.

NEW! "GENETRON" 11 PRESSURIZED SOLVENT CYLINDER

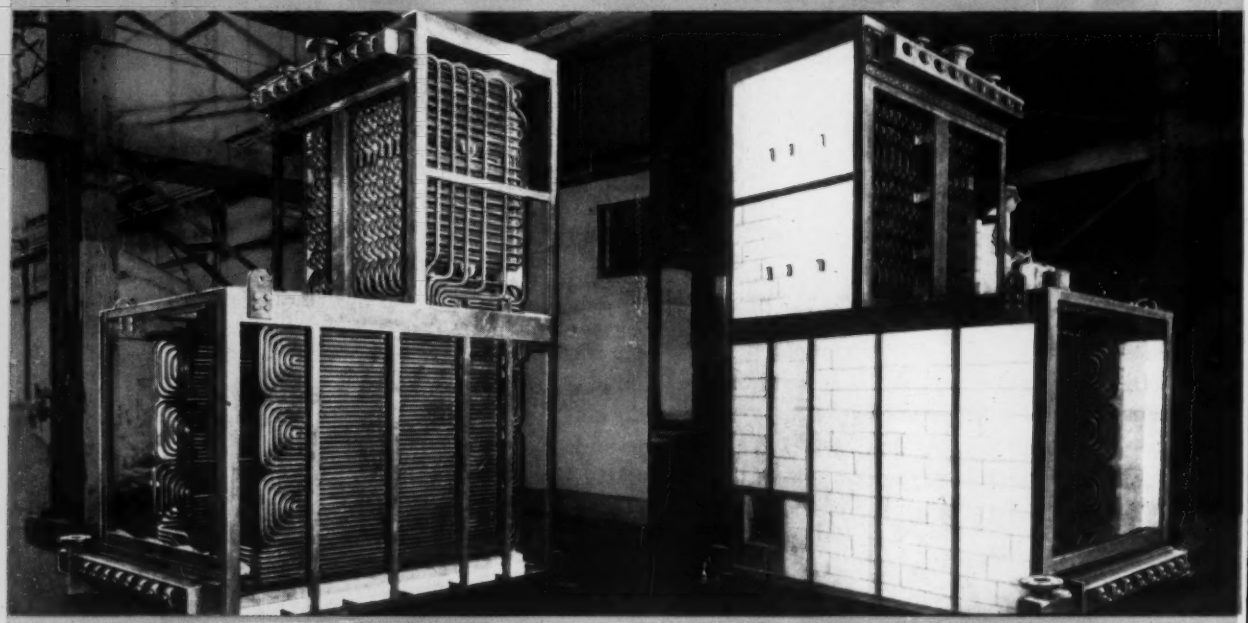
Special pressurized cylinders of "Genetron" 11 solvent provide an ideal means for cleaning out mildly contaminated systems after burnout.

Allied Chemical

GENERAL CHEMICAL DIVISION

40 Rector Street, New York 6, N.Y.

for space heating... or process heat... investigate the ECONOMY and EFFICIENCY of C-E HIGH TEMPERATURE



1 Shop assembly of 12-million Btu C-E High Temperature Water Boiler. Shows steel frame and pressure parts.

2 Same unit with refractory insulation added.

Because the C-E High Temperature Water Boiler makes more heat available than does a steam boiler operating at the same pressure . . . because it allows closer temperature control . . . does not require steam traps or elaborate feedwater treatment . . . has no blow down or condensate losses . . . it is finding ever-wider use in large space heating and industrial processing operations.

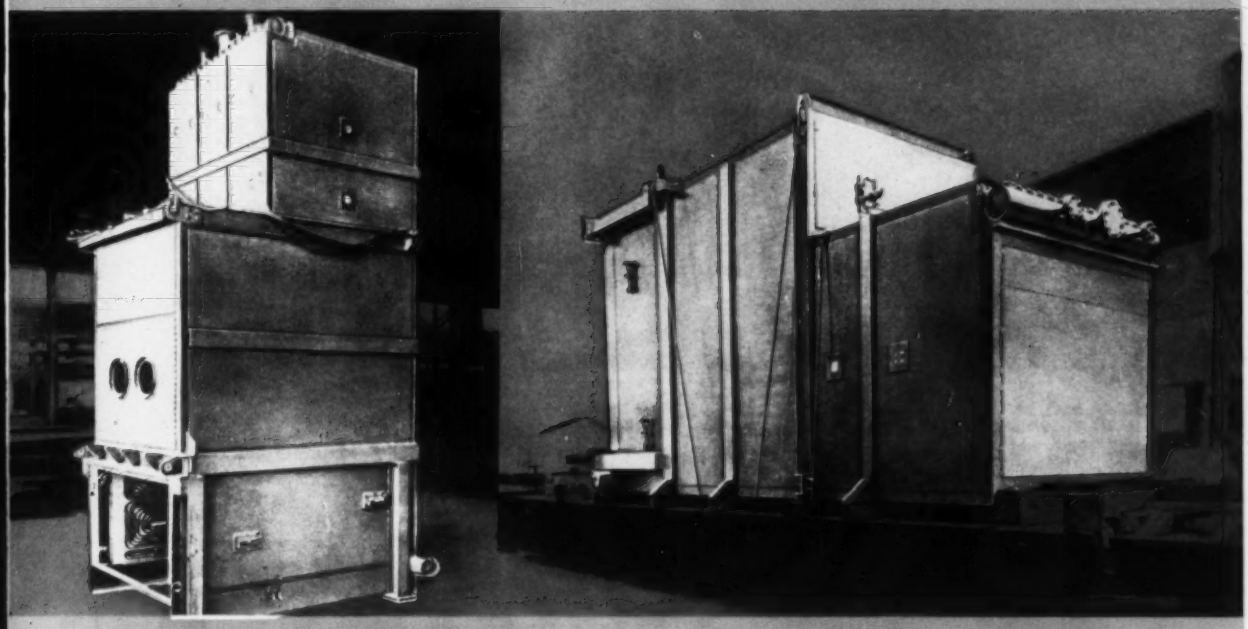
Designed around the same controlled circulation principle used by C-E in many of the world's largest boilers, the C-E High Temperature Water Boiler (Type HCC) operates with low pressure loss. It offers complete control of system and boiler circulation and allows more efficient arrangement of heating surface. It is available for oil, gas, coal or combination firing.

Designed in a wide range of capacities – from 10 million to 300 million Btu's – these boilers operate at water pressures up to 500 psi and temperatures to 470F, or higher. Depending upon local conditions, a C-E Hot Water Boiler can save from 10 to 20 per cent in maintenance and operating costs.

The smaller capacity Hot Water Boilers are completely shop assembled, while the intermediate and large units are shipped in varying stages of assembly.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS

WATER BOILERS



3 A 25-million Btu unit completed with welded casing, ready for shipment. Cables are attached to lifting lugs.

4 Compact, completely shop-assembled units from 20 to 35-million Btu are shipped this way.

This C-E practice greatly reduces erection costs.

So, if you are in the market for boilers, either for space heating or process requirements, it may prove to your advantage to investigate the use of high temperature water as your heat source. Because individual needs vary, both steam and hot water have their place. Our engineers will be pleased to discuss either method with you or your consultants – impartially and with no obligation.

For further details on high temperature water boilers by C-E write for our catalog HCC-2.

COMBUSTION ENGINEERING

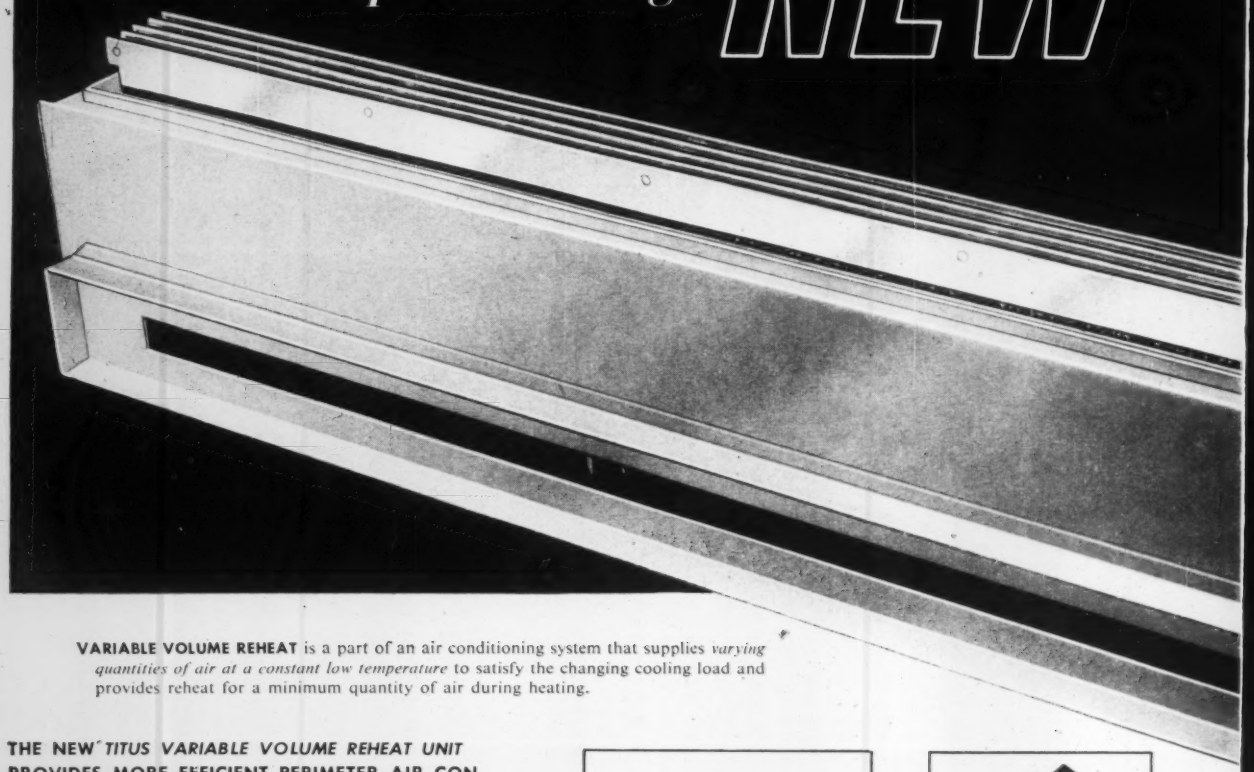
C-306

General Offices: Windsor, Conn.
New York Offices: 200 Madison Avenue, New York 16, N. Y.
Canada: Combustion Engineering-Superheater, Ltd.

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

another first from the leader in air distribution product design

NEW



VARIABLE VOLUME REHEAT is a part of an air conditioning system that supplies *varying quantities of air at a constant low temperature* to satisfy the changing cooling load and provides reheat for a minimum quantity of air during heating.

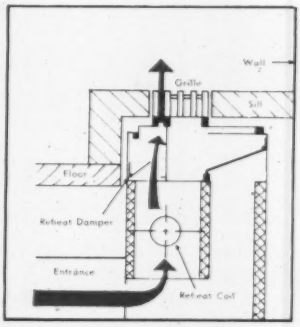
THE NEW TITUS VARIABLE VOLUME REHEAT UNIT PROVIDES MORE EFFICIENT PERIMETER AIR CONDITIONING, GREATER OVERALL ECONOMY—MORE FLEXIBILITY IN ARCHITECTURAL DESIGN

This new unit assures the utmost in complete and continuous control of individual space temperatures and ventilation the year around. *Each unit can respond to a wide range of heating and cooling demand — WITH AMAZING EFFICIENCY AND ECONOMY.* Can be used with low or high pressure systems.

LOWER INITIAL EQUIPMENT COSTS . . . As an example, fan capacity can be much less when Titus Variable Volume Reheat units are used. Due to solar orientation, all perimeter areas do not require maximum cooling or maximum flow at the same time. *With variable volume it is then possible to design the fan capacity by the cooling air flow required at a specified time, rather than the total of the maximum flow required at each outlet in the perimeter area* as would be the case with a constant air flow system.

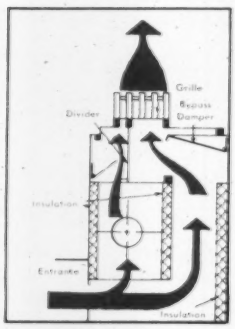
LOWER OPERATING COSTS . . . Operating costs are greatly reduced during heating because only about ¼ of the maximum flow need be supplied with Titus Variable Volume Reheat units. ADDITIONAL SAVINGS on heating equipment and fuel costs are realized from the low air flow since A MINIMUM OF COOL PRIMARY AIR IS REHEATED. Operating costs during cooling are less, too, because unit supplies *varying quantities* of cooled air to satisfy changing cooling load.

GREATER DESIGN FREEDOM FOR ARCHITECT . . . When conventional units such as convectors, mixing boxes, etc., are used in perimeter air conditioning, they often cause unsightly, cluttered walls. *The new Titus Variable Volume Reheat units can be installed under the floor with the outlet flush with the floor . . .* or above the floor at any height desired.



REHEAT AND MINIMUM FLOW THROUGH TITUS VVR UNIT

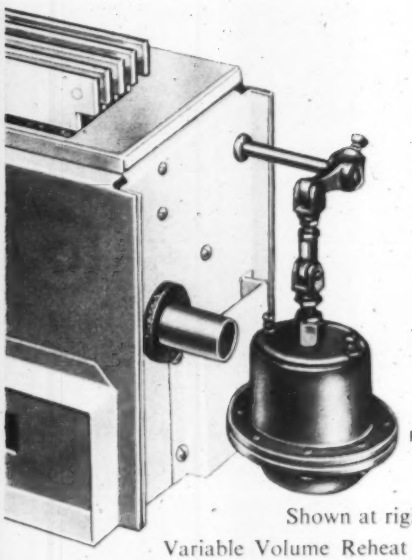
When heating is required, a damper shuts off about three-fourths of air flow through unit allowing minimum flow of cool air to pass through unit and be heated by finned tube. When reduced heating is called for, flow of hot water is gradually shut off until no heating of air takes place. Now unit very efficiently provides minimum cooling with same flow rate as before.



FULL COOLING AND MAXIMUM FLOW THROUGH TITUS VVR UNIT

When thermostat calls for more cooling, pneumatic motor begins opening by-pass damper and more air is then allowed to flow through unit until damper is full open and maximum flow and full cooling is reached. (Maximum flow is approx. 4 times greater than minimum flow). UNIFORM AIR DISTRIBUTION is possible with Variable Volume Reheat unit because the division of air flow through the grille provides a constant velocity leaving the grille.

Variable Volume Reheat unit by TITUS®



PATENT PENDING

✳ *developed in conjunction with Minoru Yamasaki... Smith, Hinchman & Grylls, Associated Architects and Engineers*

TESTED AND PROVED in a 2-story mock-up of the new Michigan Consolidated Gas Company Office Building in Detroit

Shown at right is actual photo of new Titus Variable Volume Reheat units installed in mock-up of Michigan Consolidated Gas Company Office Building. The units were installed under the floor with a 3-inch pre-cast concrete sill containing Titus extruded aluminum Linear Grilles as outlets. *The new Titus VVR units fully met all requirements of the variable volume reheat system.* They proved capable of maintaining room temperature within 1 F—with varying heating and cooling loads.

MAIL COUPON FOR COMPLETE INFORMATION

TITUS MFG. CORP., WATERLOO, IOWA

Please rush new CATALOG giving complete details on the new Titus Variable Volume Reheat unit.

NAME _____

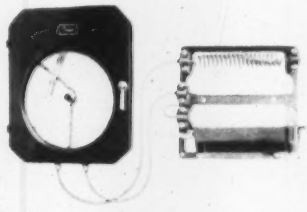
COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

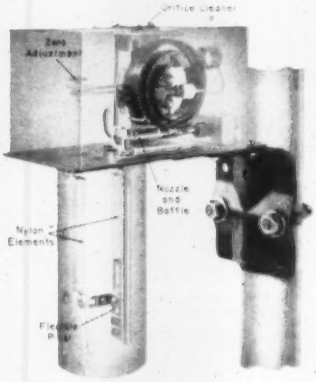
Humidity Control problems?

Let Taylor solve your measurement or control problems. Ask your Taylor Field Engineer or write for literature. Taylor Instrument Companies, Rochester, N.Y., and Toronto, Ontario.



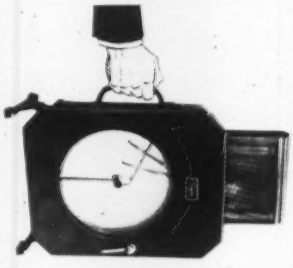
For High Accuracy Even at High Temperatures

This Taylor Recording or Recording-Controlling Hygrometer can be equipped with bottle or continuous water feed. For applications where air circulation is good, such as inside the apparatus room, or inside the duct. Where circulation is poor a suction fan should be provided to get the air moving across the bulbs. Special provision for temperatures to 400°F.



When Transmission Is Necessary

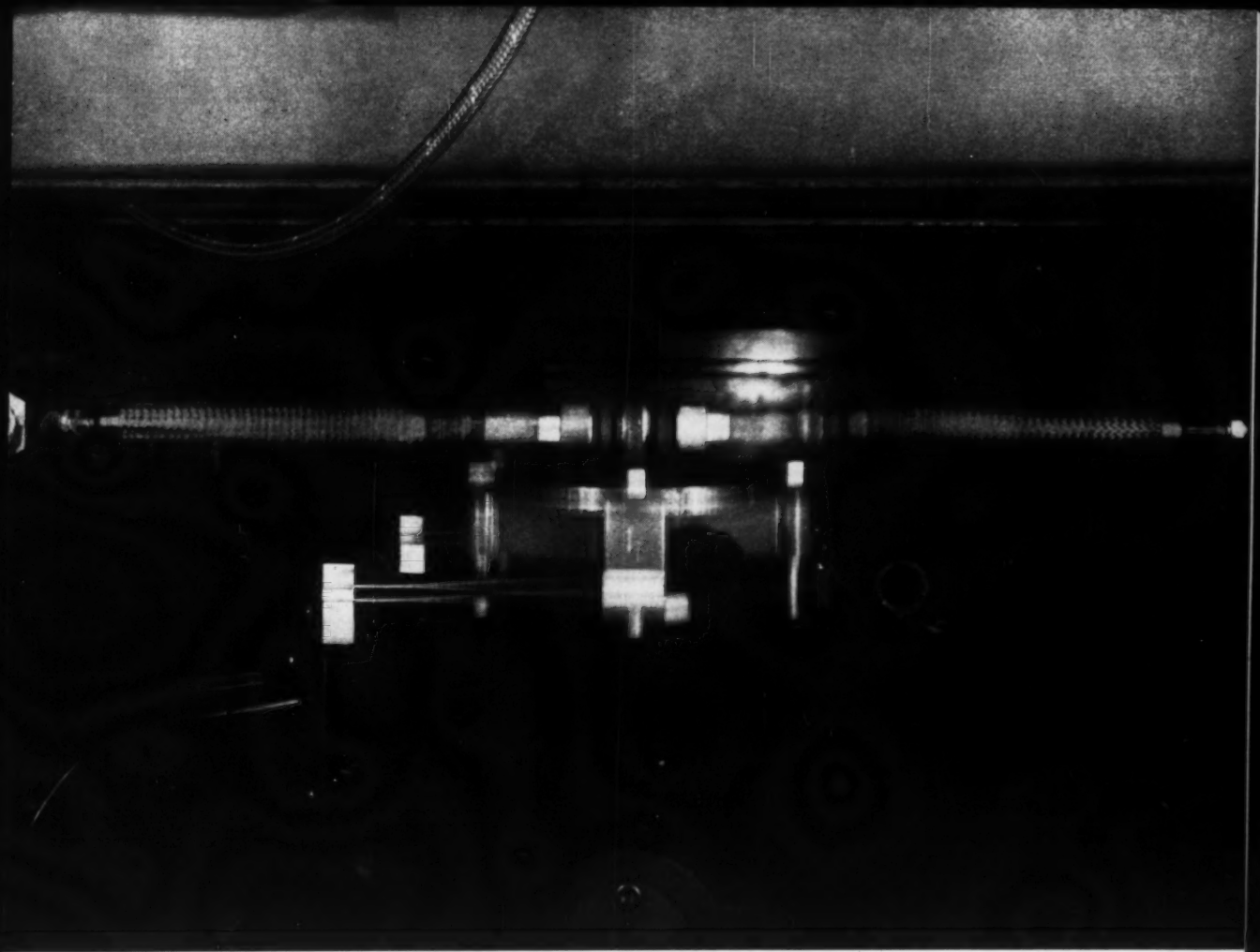
Taylor 207T Relative Humidity Transmitter is a non-indicating, pneumatic, motion-balance instrument. It produces an air output pressure (3-15 psi) proportional to the relative humidity around the sensing elements, permitting a direct reading in the receiving instrument. Zero setting can be checked against wet and dry bulb hygrometer—adjusted with knurled nut on Bourdon spring take-off arm.



For Portability and Easy Reading

New Taylor 100J Relative Humidity Recorder is actuated by Nylon Fibre elements that change in length with variations in moisture content. Magnified by special mechanical linkage, this change in relative humidity is recorded directly on easy-to-read 24-hour chart. There are no conversions to make, no troublesome wicks to change, and accuracy is unaffected by periodic saturation. Weighs only 25 pounds.

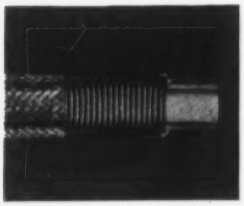
Taylor Instruments **MEAN ACCURACY FIRST**



WE TORTURE ANACONDA VE's TO FIND OUT HOW THEY'LL STAND UP UNDER ON-THE-JOB PUNISHMENT

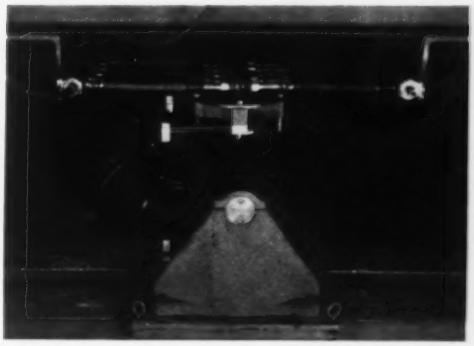
We torture Anaconda VE's in a vibratory fatigue testing machine (above) to find out if there's anything we can do to extend their service life and reliability.

Naturally we're also curious to find out how they stack up with competition, and we put other makes in the machine with Anaconda VE's. Over the years, we've found that Anaconda VE's come out better. But frankly, we were surprised at the results of our most recent tests. Because *we discovered that Anaconda VE's were lasting more than twice as long as the nearest competitor and over 5, 6, and 8 times longer than other makes.*



Anaconda VE, the only connector having a flexible core of seamless tin bronze and special high-tensile bronze wire braiding — for longest service in dampening vibration in piping.

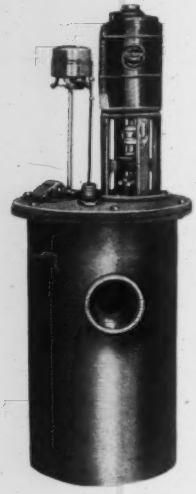
Anaconda Vibration Eliminators – recognized by Underwriters' Laboratories, Inc. under File SA2585–are sold by leading air conditioning and refrigeration wholesale distributors everywhere. For engineering information, write: Anaconda Metal Hose, P.O. Box 791, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 6115B



This fatigue testing machine applies a sinusoidal vibration. VE's are pressurized during the test. And test parameters selected give an accelerated test, yet are not so severe as to cause premature failure which would invalidate results.

ANACONDA® VIBRATION ELIMINATORS VE's

Specify Skidmore



TYPE UV

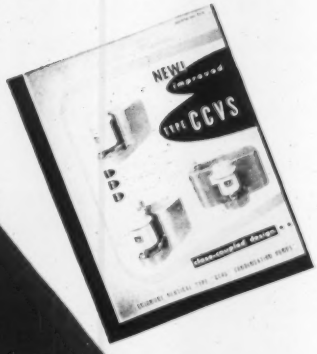
Designed for return of condensate to the boiler or other points from all types of steam heating systems or process equipment. The UV pump features a NEW wide range of pump types, sizes, capacities and pressures. Pump can be installed with the receiver underground and the receiver cover plate flush with the floor. Manufactured in both the single and duplex units. Pump unit is bronze fitted throughout.

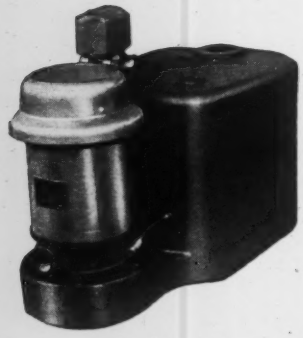
THE PUMP THAT OFFERS CUSTOM DESIGN AT A STANDARD PRICE

WRITE FOR YOUR COPY OF BULLETIN No. 19-B

2 New Bulletins

WRITE FOR YOUR COPY OF BULLETIN No. 21-C





TYPE CCVS

High pump efficiency with a minimum motor size . . . the CCVS vertical pump features close-coupled design and mechanical shaft-seal. Complete pump and motor unit is bolted to receiver. Manufactured in both single and duplex units, pump can be installed on floor level or in pit. There are three new single units and two duplex units offering a choice of two float switches or automatic alternator in the duplex units.

FOR PUMP PERFORMANCE NOT PUMP PROMISES SPECIFY SKIDMORE

SKIDMORE PUMPS

SKIDMORE CO[illegible] ST. JOSEPH, MICHIGAN

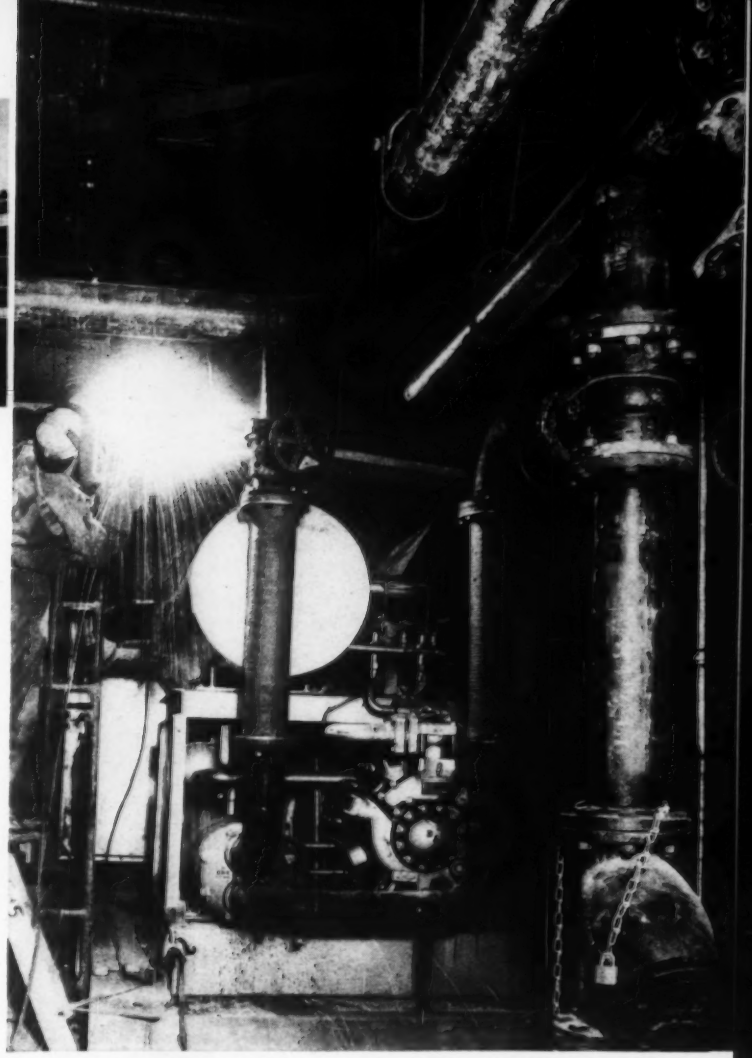
SPANG CW STEEL PIPE

Spang Steel Pipe is expected to outlast the life of this beautiful new 525 Thayer Avenue Apartment Building, Silver Spring, Maryland.

Architect: Edmund W. Dreyfuss, Washington, D.C.
Mechanical Engineer: Shefferman & Bigelson, Washington, D.C.
General Contractor: Arnold Perry & Associates, Silver Spring, Maryland
Piping Contractor: Jack Schwarz & Son, Washington, D.C.
Spang Distributor: E. G. Schafer & Company, Washington, D.C.

Q. "HOW DID THIS PIPING JOB GO, MR. SCHWARZ?"

A. "It was really a pleasure to work with SPANG pipe!"



Nearly three miles of Spang Black and Spang Galvanized Pipe in ½" to 5" diameter were installed in two Silver Spring apartments. Contractor reports a smooth, trouble-free installation.

"We never had the first bit of trouble with it." Those are comments by Mr. Irwin Schwarz, secretary-treasurer of Jack Schwarz & Son, Washington, D.C. We interviewed Mr. Schwarz about the two Spang Steel Pipe installations his company was making: the 37-unit 700 Sligo Avenue Apartment and the 74-unit 525 Thayer Avenue Apartment in Silver Spring, Maryland.

Here's what else Mr. Schwarz said: "We installed nearly three miles of Spang Black and Spang Galvanized Steel Pipe. Each length was tested on the job site at 200 psi, and the tests turned out just as we expected—fine!

"Spang Pipe was used on all plumbing, vent lines and combination air conditioning and heating lines. On these combination lines, temperature range goes from 40° to 140° F; this calls for rugged pipe!

"Spang Pipe threads nicely and bends and welds easily. It's our considered opinion that steel pipe is more economical than copper and performs every bit as well. Spang Steel Pipe is a good Grade A uniform product and should last as long as the buildings . . . probably longer."

Want fast, trouble-free installations?

Join Mr. Schwarz and thousands of other leading contractors who have found Spang Steel Pipe uniformity offers excellent working advantages and time saving jobs. Call your nearby Spang Distributor for service. Spang Steel Pipe is one of the many fine products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pennsylvania.*

Steel

Steel's Symbol of strength, long life, and economy

ARMCO National Supply Division

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NEW BRUNSWICK, NEW JERSEY • TAPES • ELECTRICAL INSULATING MATERIALS • ADHESIVES

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CONTROLLING FLOW SINCE 1914

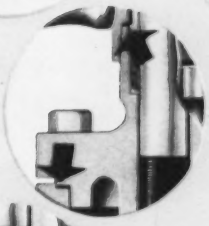
WING CAP SHUT-OFF VALVES

Globe and Angle Types with Bolted Bonnet and Full Capacity Flow

Henry offers the most complete range of sizes and types in the industry. Quality engineering, features of design, proven performance and adaptability to the most exacting specifications and diversified applications have made Henry Wing Cap Valves preferred by architects, consulting engineers, contractors and service men.

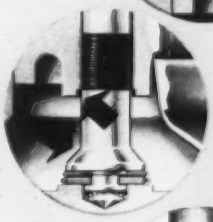
WING CAP SEAL

With Built-in Socket Wrench. For Ease and Convenience in Operating Valve Stem.



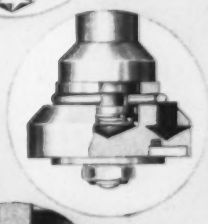
PROTECTIVE GASKETS

Fully Retained. Prevent Loss of Expensive Refrigerant.



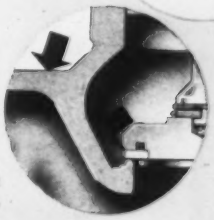
BACK SEATING STEM

Can Be Repacked Under Pressure.



NYLON SEAT DISC

Replaceable, Non-rotating, Self-aligning, Chatterproof.



HEAVY WALL & WEB

Choice of Bronze Alloy or Semi-steel.

Bronze alloy valves have integral O.D.S. connections. Ductile iron valves available with integral F.P.T. connections; flanged type available with brass O.D.S. or steel butt-weld adapters.

HENRY VALVE COMPANY

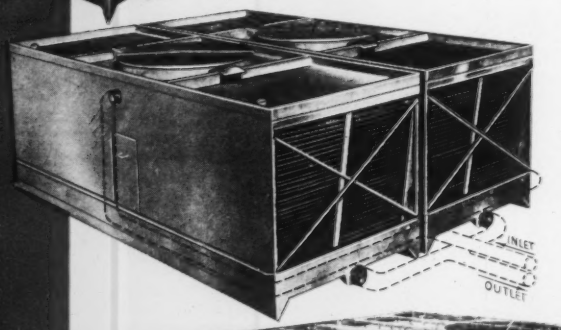
For Refrigeration, Air Conditioning and Industrial Applications

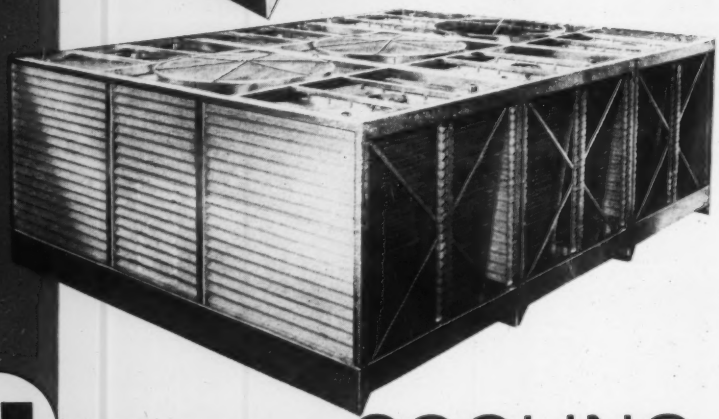
MELROSE PARK, ILLINOIS, U.S.A. CABLE: HEVALCO, MELROSE PARK, ILL.

Havens COOLING TOWERS

PERFORMANCE PROVEN for

- AIR CONDITIONING
- REFRIGERATION
- INDUSTRIAL PROCESSES





FEATURING

QUALITY *AND* LONG LIFE

Havens COOLING TOWERS
DIVISION OF **HAVENS STRUCTURAL STEEL COMPANY**
1713 CRYSTAL AVE., KANSAS CITY 26, MISSOURI

FREE

SPECIAL OFFER FROM

UCON IKE:

THE SHIRT OFF HIS BACK

For buying Ucon® Refrigerants in 125-lb. and 145-lb. cylinders

With the big season coming up, now's the time to stock up on refrigerants . . . and buying 125-lb. and 145-lb. cylinders of Ucon Refrigerants is the smart, convenient way to do it. This larger size cylinder offers you economy and storage convenience . . . and to encourage you to prove it to *yourself*, Ucon Ike is pleased to make this stupendous offer:

For a limited time only—April 1st through 30th—
yours FREE with the purchase of two 125-lb. or 145-lb. cylinders of Ucon Refrigerants:
A Gen-u-wine Ucon Ike Sport Shirt

A handsome yellow checked, short sleeved "Van Heusen" sport shirt in comfortable cotton—the kind Ike wears on his vacation. Ideal for work, play, any day—from Northland to backyard hammock.

To get your shirt: Under the brass dust cap on the valve of every 145-lb. cylinder of Ucon Refrigerants (125-lb. cylinders of Ucon Refrigerant 22, too), you'll find a Ucon Ike Seal. Simply mail two of these seals, together with your name, and the name of your wholesaler on your company letterhead to: Ucon Ike, P.O. Box 1010, Grand Central Station, New York 17, N. Y. Applications must be postmarked no later than April 30th, and no earlier than April 1, 1961. And don't forget to include your shirt size! (Small, Medium, Large or Extra-Large.) While you're at it, any comments you'd care to include on the Ucon Refrigerants line will be most welcome. As soon as we hear from you, your Ucon Ike Sport Shirt will be rushed on its way.

*Remember—this offer is good from April 1st through April 30th only!

For Economy & Convenience plus The Shirt Off Ucon Ike's Back—FREE
Specify 145-lb. Cylinders of Ucon® Refrigerants

a UNION CARBIDE product — Ucon® refrigerants — exclusive sales agent ANSUL

Ucon Refrigerants are manufactured by
UNION CARBIDE CHEMICALS COMPANY — Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

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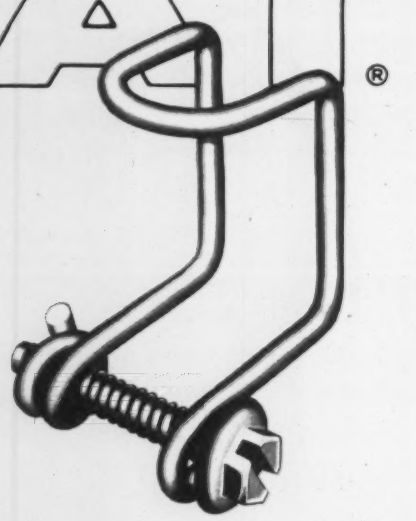


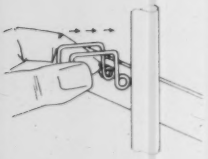
CONDUIT AND TUBING CLAMPS

Designed for quick, easy installation for rigid positive holding of ½", ¾" and 1" conduit or tubing.

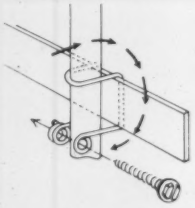
Equipped with self-tapping screw—only a screw driver required for installation.

Used with low cost 1½" strap, greater savings are realized over commonly used angle, U-bolts and drilling.

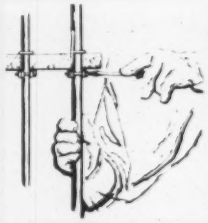
INSTALLATION INSTRUCTIONS



STEP 1—Push open end of GAT conduit clamp straight in over conduit with small loops down.



STEP 2—Bring open end down around sub girt bar or strap until small loops pass conduit outwards.



STEP 3—Insert screw and tighten.

SIZING CHART

CAT. NO.	DESCRIPTION
8 C 1.5L	½" EMT to (⅛" or 3/16") x 1½" Strap
	½" Copper Water Tube (3/16" or ¼") x 1½" Strap
12 C 1.5L	¾" EMT to (⅛" or 3/16") x 1½" Strap
	¾" Copper Water Tube (3/16" or ¼") x 1½" Strap
	½" Rigid Conduit & Water Pipe—(3/16" or ¼") x 1½" Strap
16 C 1.5L	1" EMT to (⅛" or 3/16") x 1½" Strap
	1" Copper Water Tube (3/16" or ¼") x 1½" Strap
	¾" Rigid Conduit & Water Pipe to (3/16" or ¼") x 1½" Strap

Packaged 50 per box, approximately 5# per 50.

FASTENER Div. | ERICO CADWELD PRODUCTS, INC.
2070 EAST 61st PLACE • CLEVELAND 3, OHIO

SWORDS OF DAMOCLES

Every editor of a businesspaper, like the King's courtier of Greek legend, lives with a sword of Damocles suspended over his head.

Some of them have it tougher—they live with thousands of them. One for each subscriber.

The under-one-sword editor has things a bit easier – his publisher holds the sword, and readers don't get much chance to use it. These are the papers whose recipients pay no subscription price, but get the publication more or less over the transom.

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But the system has its compensations, too: this kind of editor has to be on his toes all the time. His publication has to be good—or else. So the advertiser using such a publication can be pretty sure its readers want it—and keep on expressing their approval year after year by renewing their subscriptions.

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The plus value of paid circulation is "wantedness"

No. 3 in a series for your SPEC. FILE †

Suggested specifications for insulating INDOOR CHILLED PIPING with G-B SNAP*ON® Glass Fiber PIPE INSULATION

DESCRIPTION

The effective reduction of heat gain in chilled piping hinges on the quality of the insulation. That's why G-B Snap•On, the original one-piece hinged pipe insulation molded entirely of fine glass fibers, is your best insulation buy. Ideal for cold and heated piping from sub-zero to 350° F., G-B Snap•On's thermal efficiency is second to none among all general purpose pipe insulations. Because it is made entirely of glass fibers, G-B Snap•On pipe insulation offers all the advantages of glass itself. It will not burn, rot, mildew, corrode or otherwise deteriorate. G-B Snap•On provides **permanent** insulation protection. What's more, its lightweight, highly resilient glass fiber construction makes it easy to handle and apply and highly immune to damage. G-B Snap•On is manufactured in thicknesses from ½" to 3" in 3' and 6' lengths.

MATERIAL SPECIFICATIONS

PLUMBING—thermal insulation for COLD WATER PIPING above 50°
Insulating Material—All cold water service piping shall be insulated with Gustin-Bacon Snap•On glass fiber pipe insulation in one piece molded sections ...." thick. Piping shall be clean and dry and shall be tested before insulation is applied.

CHILLED DRINKING WATER PIPING
Insulating Material—All chilled drinking water piping shall be insulated with Gustin-Bacon Snap•On glass fiber pipe insulation in one piece molded sections ...." thick with factory-applied vapor barrier jacket. Piping shall be clean and dry and shall be tested before insulation is applied.

AIR CONDITIONING & DUAL TEMPERATURE PIPING—thermal insulation for chilled water or combination hot and chilled water supply and return piping from 50° to 212° F.
Insulating Material—All chilled water or dual temperature heating and cooling lines to air conditioning equipment and return shall be insulated with Gustin-Bacon Snap•On glass fiber pipe insulation in one piece molded sections ...." thick with factory-applied vapor barrier jacket. Piping shall be clean and dry and shall be tested before insulation is applied.

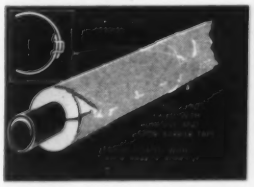
APPLICATION SPECIFICATIONS

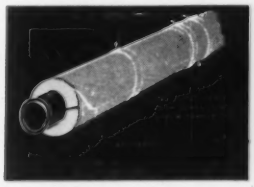
All covering shall be applied to the pipe with end joints tightly butted and the single longitudinal seam closed.

Ends of pipe insulation shall be sealed off to the pipe with vapor barrier adhesive or mastic at all flanges, valves, fittings, hangers, and at intervals of not more than 12' on continuous runs. Hanger rods in direct contact with the pipe shall be insulated separately for a distance upwards of 6" to 12". At hangers where pipe is supported by the insulation an 18 gauge metal saddle shall be provided under the insulation outside of the vapor barrier jacket. Its length shall be three times the pipe diameter with a minimum of 10". Jacket end joints shall be covered with factory furnished vapor barrier tapes secured with vapor barrier adhesive and staples or aluminum bands.

EXPOSED PIPING

WHITE COATED VAPOR BARRIER JACKET All piping exposed to view shall be insulated with factory furnished white coated jacket applied as above except use of clear quick tacking adhesive.





CONCEALED PIPING

VAPOR BARRIER JACKET WITH FLAPS STAPLED AND SEALED Longitudinal insulation seam shall be closed by stapling the factory applied jacket overlap with outward clinch staples on 3" centers after overlap has been coated with vapor barrier adhesive. All staples shall be coated with vapor barrier adhesive.

VAPOR BARRIER JACKET FLAPS BANDED AND SEALED Longitudinal insulation seam shall be closed with copper-clad insulation staples inserted across the seam and at an angle with the pipe surface. Vapor barrier jacket overlap shall be adhered over the staples with a quick tack vapor barrier adhesive. Three bands per section to be applied after jacket and tapes are sealed.

(CUT ALONG THIS LINE)

RECOMMENDED JACKETS FOR G-B SNAP*ON PIPE INSULATION FOR CHILLED PIPING

Ordering Name	Description	Sec. Length	Vapor Barrier	Where to Use
Dual-Temperature Jacket	A three layer laminate of 2 asphalt saturated crepe paper sheets adhered to each side of a .001" aluminum foil. Moisture vapor transmission rate of less than .01 perms. Factory applied with either black or white surface and a 2" longitudinal flap for sealing seam. 4" tapes for sealing end joints factory supplied.	3'	Yes	On interior cold water, dual temperature service and refrigerant lines. Available in black finish for concealed work, or white finish where appearance is important. When used out of doors an additional weatherproofing jacket is required.
Flame Resistant Jacket	One layer of 40-lb. flame resistant crepe Kraft laminated to a .001" aluminum foil with fire retardant asphalt. Moisture vapor transmission rate of less than .01 perms. This jacket has passed laboratory flame resistant tests ASTM D 777-46 and TAPPI-T-46LM-48 as follows: After flame time 0 to 1 second. After glow time 0 seconds. Furnished with a 2" overlapping longitudinal seam and 4" wide tapes to seal end joints.	3'	Yes	On interior cold water, chilled, dual-temperature service and refrigerant lines where flame resistant characteristics are required. The aluminum foil surface presents a finished appearance. When used out of doors an additional weatherproofing jacket is required. (NOTE: Unless otherwise notified, Aluminum Foil is applied next to pipe insulation.)

† Complete series of G-B Snap•On specifications will appear in this publication in the coming months. Each will be designed to be clipped from the publication and placed in your spec file. However, if you would like to have all G-B Snap•On specifications at this time, simply write:

GUSTIN-BACON *Manufacturing Company*
220 W. 10th St., Kansas City, Mo.

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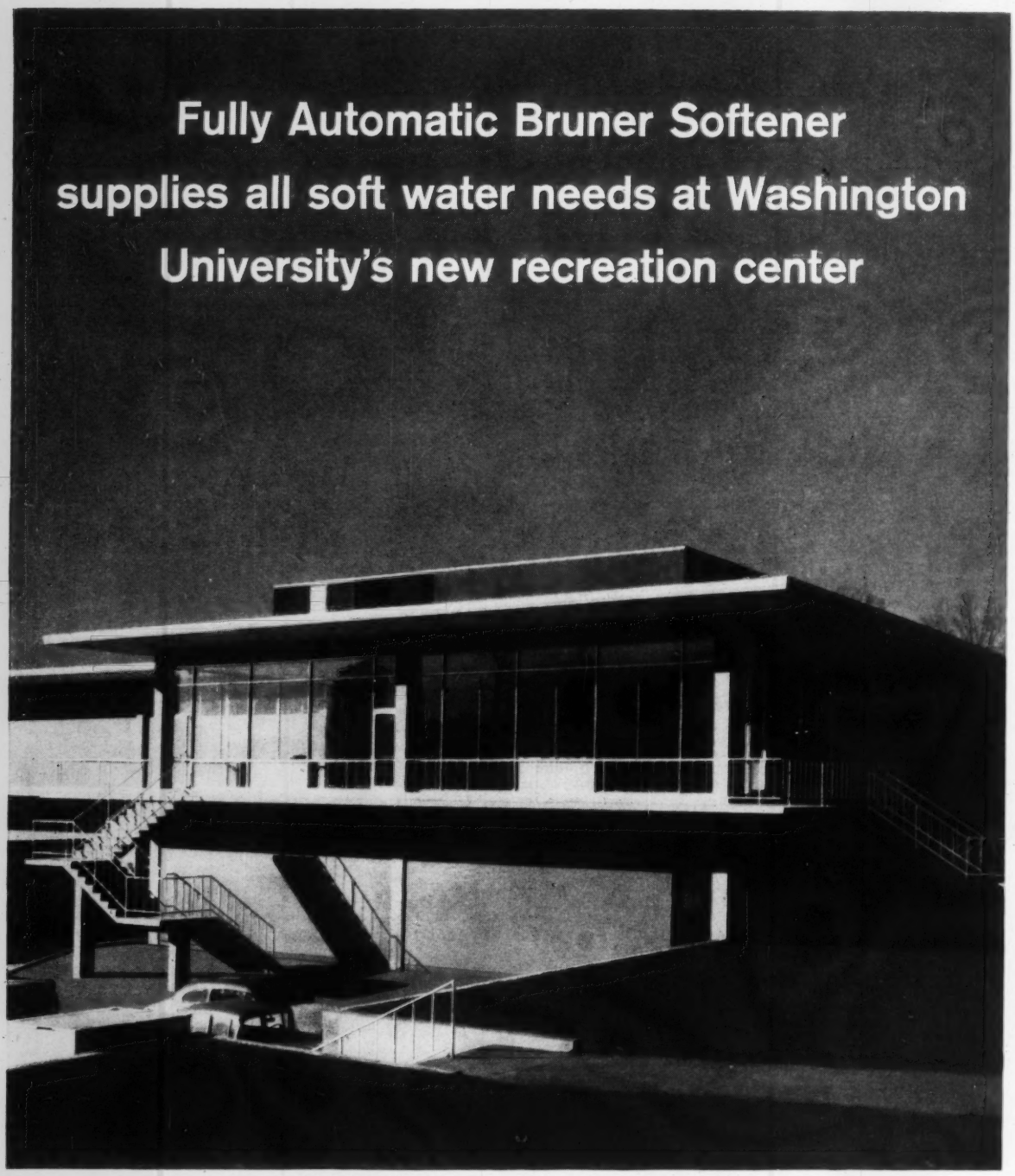
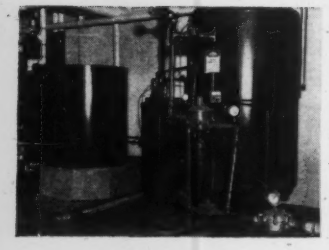
Thermal and acoustical glass fiber insulations . . . Molded glass fiber pipe insulation . . . .Couplings and fittings for plain and grooved end pipe

Fully Automatic Bruner Softener supplies all soft water needs at Washington University's new recreation center



Architects for the Center: Hellmuth, Obata & Kassabaum, Inc., St. Louis Mo.
Plumbing contractor: E. J. Fischer Plumbing Co., St. Louis, Mo.

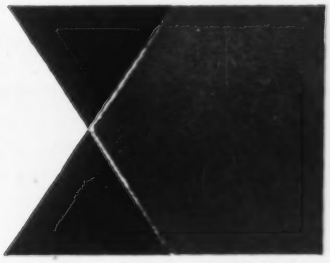


Bruner has provided the first water softener on the University campus in St. Louis for the David P. Wohl Center, a dining and recreation hall able to serve 1200 students 3 times a day. This fully automatic Bruner water softener features a reset head meter and automatic by-pass for ease of operation and maintenance, providing soft water for washing over 4000 dishes daily. Here, and across the U.S., leading engineers specify Bruner water softeners, America's most complete line.

FULL INFORMATION IS AVAILABLE FROM BRUNER SALES OFFICES IN ALL MAJOR CITIES. BRUNER CORPORATION, 4767 NORTH 32ND STREET, MILWAUKEE 9, WISCONSIN. PLANTS IN MILWAUKEE, WISC., AND LOS ANGELES, CALIF.

BRUNER
WATER SOFTENERS & FILTERS

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.



"Open for Discussion"

Sound Output Analysis Is Important, But New Method May Add Confusion

I HAVE READ with interest the article, *Proposed: A Simplified, Comparable Method for Rating the Sound Output of Air Distribution Equipment* (February). I believe that Mr. Spradling has included many important comments on the state of the art of measuring the sound output of air-conditioning devices. However, I am afraid that if his recommendation for a single number, the PWL-NC index, to describe the sound output of a device were adopted, it would tend to limit the effectiveness of the full sound power level *vs* frequency data which is so important for the acoustical engineer when he is required to make a detailed analysis of the noise levels from an air-conditioning system.

Mr. Spradling's proposal is in effect a method by which the device is rated in accordance with the octave band having the highest NC level. However, such information would not be helpful to the design engineer working to provide a given sound level in a room having a room factor which varies with frequency, this being the usual case.

I also believe that the introduction of an additional number or index would only tend to confuse the consulting mechanical engineer who is already required to know far more about acoustics than in years past. I believe it would be simpler for such engineers to learn the fundamentals of handling sound pressure level and sound power level as a function of frequency than it would be to learn these plus a special index, which on a few occasions would simplify operations, but, in general, would only be one more number to have to consider.

In addition, the proposed use of the power level spectrum and the sound pressure level spectrum almost interchangeably could lead to further confusion. My own experience in discussing problems of the sound ratings of duct mufflers with consulting mechanical engineers has convinced me that standard methods, no matter how detailed, must be provided for the rating and measurement of the sound output or sound attenuation of devices in the air-conditioning field. No matter how detailed such methods are, the engineers will use them as long as they provide the necessary information without ambiguity.

In closing, I must say that Mr. Spradling's stress on the need for sound power level measurements and the importance of their use in rating air-conditioning devices is to be commended, and I am in full agreement with him on this point.

I should also like to call attention to a problem in terminology which appears. Mr. Spradling, in describing the ASHRAE proposed method for testing devices, says that this method includes "measuring the room attenuation in each octave band," and this is a difficult item to interpret. I am aware that he intends this to mean the measurement of the difference between the sound power level and the sound pressure level in the reverberant field. However, as stated this implies that we are measuring some attenuation factor in the room which would reduce the sound pressure level between two points.

LEWIS S. GOODFRIEND
Lewis S. Goodfriend & Associates
Consulting Engineers in Acoustics

THE AUTHOR'S REPLY — Lewis S. Goodfriend is correct that this simplified method does not provide sufficient information for a detailed accounting of the sound power level in each octave band as required by the acoustician.

Mr. Goodfriend's comments are appreciated. Had they been received in time I would have added the statement that the manufacturer should, upon request, provide the sound power level octave band spectrum.

Continued on page 96

"Open for Discussion"

Continued

This will be no hardship for the manufacturer, since he must first determine this information in order to establish the PWL-NC Index. Thus, the acoustician will be served by the spectrum analysis as will be the design engineer by the simplified rating.

As stated in the article, this new method is not proposed as a substitute for octave band analysis; but, rather as a substitute for the non-comparable single number ratings based upon sound pressure levels.

It is my conviction that the majority of consulting engineers engaged in air conditioning system design have not yet found the need to become familiar with sound power levels, to say nothing of octave band analyses.

I believe that the profession and industry will be best served by encouraging the engineer to first become conversant with sound power levels on a simplified basis. Then, after this concept has become familiar he will be more receptive to expanding his thinking to embrace octave band analyses.

With regard to Mr. Goodfriend's concern over a possible misunderstanding of the term "room attenuation," I think the meaning can be clarified by reference to the glossary in the article, where it is defined as PWL minus SPL, db.

JOSEPH W. SPRADLING
Carnes Corp.

Notes Added Considerations In Selecting Hospital Air Conditioning

JOHN A. HOLBROOK, author of the article, *Hospitals: A Challenge to Air Conditioning Engineers* in the January issue, has done a good job in setting forth the basic problems in the design of hospital air conditioning systems. However, the treatment of each type of air conditioning system has been over simplified in some cases.

There are several disadvantages to self-contained air conditioning units and to room fan-coil units that should be included. The self-contained units have the common habit of short-cycling because of their inherent design. Coil depths and fin spacing are not generally variable, so the engineer has reduced the range of selection to meet the load conditions.

This is specially so where the unit is to handle 100 percent outside air. The 1 in. or 2 in. filters on these units are ineffective as compared to the quality of filtering that is required and which can only be met through the use of electro-static filters.

The room fan-coil units present even a worse problem in some respects. Noise of operation and high maintenance costs make these so objectionable that one wonders why they are used. On a first cost basis for a medium size hospital — say one with 200 beds — they are not economical if auxiliary ventilation air is to be supplied and year-round humidity control is to be considered. The temperature regulation control should provide for some means of never allowing the fan to be shut off or to provide for positive shutoff of the chilled water circuit should the supply fan be shut off. The reason for this is that while the fan is down and chilled water flowing through the coil, the lower part of the cabinet will sub-cool below room dew point and form a condensing surface. Again, the filtering system on these is insufficient.

The concensus of opinions is that the design of a hospital air conditioning system should not permit recirculated air between rooms. It is realized that this necessitates 100 percent outside air and thus high operating costs. We should not fail to recognize that the hospital's main function is to provide a quality of medical care that will enable the patient to return to a healthy active life with the least amount of time in the hospital. The patient's medical welfare cannot be jeopardized by irregular design practices.

ROBERT W. FLANAGAN
Engineer
Daniel B. Stevenson, Jr.
Consulting Engineer

More Comments on Air Conditioning Applications In Modern Hospitals

I HAVE READ the article, *Hospitals: A Challenge to Air Conditioning Engineers*, by John A. Holbrook in the January issue, and my comments have to do with the air conditioning of only the patient's room sections of hospitals as was discussed in the article.

Of the several basic requirements essential to good air conditioning, three which he listed are:

1) Individual room control
2) Humidity control
3) Positive ventilation rate

Two features which he did not include in his list and which we feel are also essential are:

4) Satisfactory noise level
5) Uncomplicated operating and maintenance procedures

In his discussion of the various systems commonly used he failed to indicate in some cases how each system satisfied the essential requirements. Herewith are qualifications of how the various systems do or do not satisfy these essential requirements.

With reference to package units, the following shortcomings should be mentioned.

1) Final space control on an individual room basis is not satisfied.

2) Control of dehumidification is reasonably satisfactory, however, application and control of humidification for winter months is almost impossible

Continued on page 98

ANOTHER ACHIEVEMENT IN MODERN FLOW CONTROL BY CRANE

CRANE 125-AND 150-POUND UNION BONNET BRONZE GATE VALVES

STRONGER CYLINDRICAL BODY DESIGN FOR LONG SERVICE LIFE

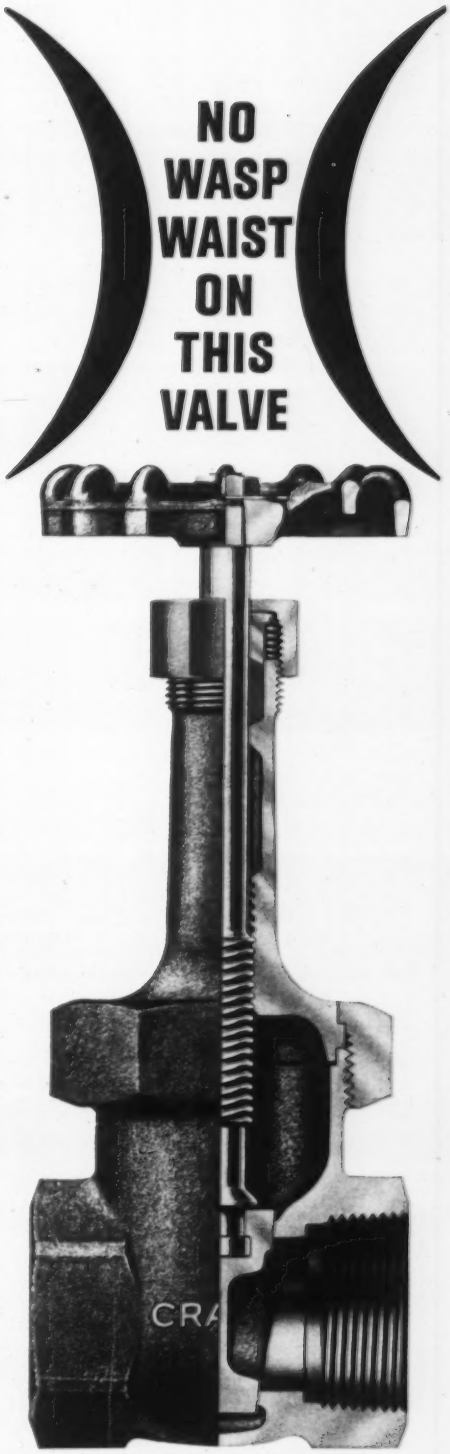
Every part of these new valves has been carefully engineered and liberally proportioned to assure an extra safety factor over the recommended working pressures. Unlike ordinary pinched-in, rectangular body valves, Crane's cylindrical body—the same design used in Crane's heavy-duty 200- and 300-pound bronze gate valves—distributes pressure loads uniformly and reinforces seat against the wedging action of the disc.

Wider, huskier hex ends combined with the new body shape give this valve greater rigidity, reduce chance of leakage and early failure resulting from piping strains. They make for easy installation, too.

Many other Crane features—the deep stuffing box that can be repacked under pressure, substantial thread engagement between stem and bonnet, and a precisely fitted bonnet joint—make this valve a best buy for safe, dependable, long service on steam, oil, gas and water lines.

Crane's 125- and 150-pound Union Bonnet Bronze Gate Valves are made in ¼-inch to 2-inch sizes with either a solid or split wedge disc. Both disc types are carefully machined and fully guided for positive, easy operation.

Your Crane Distributor has these new valves in stock. Contact him for information or write Crane Co., Industrial Products Group, 4100 S. Kedzie Avenue, Chicago 32, Ill. In Canada, Crane, Ltd., 1170 Beaver Hall Square, Montreal.



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"Open for Discussion"

Continued

and at least difficult and unsatisfactory with package units.

3) Positive ventilation rate can be satisfied. However, this feature is also a difficult one to maintain and control, especially if units are squeezed into small closets or in suspended ceiling spaces throughout the patients' areas as is usually the case.

4) Noise level of such units most often leaves something to be desired at least for those rooms adjacent to them. Mr. Holbrook mentioned that special precautions are desirable.

5) Maintenance and operation of such a system can be very undesirable because it requires an unnecessary amount of operating and maintenance personnel travel throughout the occupied areas of the hospital to service numerous relatively small units.

What About Central Station System?

Regarding the central station system, I have the following comments:

1) Final space control of the system Mr. Holbrook described does not satisfy the requirement of individual room control. It is possible, however, that with the addition of a reheat system on an individual room basis this requirement can be satisfied.

2) Humidity control must be qualified. Mr. Holbrook states that for this system it "is restricted to a zone, rather than a room basis." This statement we feel must be related to his statements on the humidity portion of the "fan-coil units" system which is the next system he describes and primarily from the standpoint of dehumidity rather than humidity. For typical patients' rooms, the only satisfactory overall way of controlling humidity and/or dehumidity is on the zone or system basis. The central station system is one of the few systems that can adequately provide and control both winter humidity and summer dehumidity for patients' rooms sections. This does not include requirements for special humidity rooms or for infrequent cases requiring higher than normal humidity in the winter.

3) The positive ventilation rate of the central system when reasonably designed is as good as that provided by any system considered.

4) The noise level of this system is the lowest of all systems employable unless extremely poor design is used. Mr. Holbrook stated, "The noise level of such a system should be low." We believe he intended to say, "would" rather than "should."

5) Maintenance and operation of this system is the simplest because most of the parts requiring maintenance are located in major equipment rooms remote from occupied areas. Also there are fewer total parts with such a system as compared to others.

6) Year around air conditioning and heating can be very satisfactorily accomplished with this system by the use of so-called under the window low pressure induction units or reheat cabinets. This equipment makes the central system a complete year 'round air conditioning system without the use of extraneous heating equipment. This method is most often the least expensive system which most satisfactorily provides all of the features of complete year 'round air conditioning for patient's rooms areas.

Comments on Fan-Coil Units

With reference to fan-coil units, the following applies:

Individual room temperature control can be satisfied in several ways with this system.

Humidity, that is the addition of moisture for winter periods, is a practical impossibility with the type of system described. Dehumidifying in the summer is strictly dependent upon the sensible gain of the specific space served by a given unit.

The dehumidifying results of a space having a relatively high sensible heat gain can be no more than satisfactory, especially with the introduction of some outdoor air through the unit as is desired and as he mentions. It therefore follows, that dehumidifying for spaces having low sensible gains will be inadequate. The reason it is inadequate is because the dehumidifying effect is proportional to the amount of cooling required. With little cooling required there may not be any dehumidifying whatever, especially with thermostatically controlled chilled water valves.

Dehumidification Is Problem

There are more total hours of low sensible gain than of high sensible gain, therefore the dehumidifying effect of this system is inadequate for the average hospital patient's room. The hours that rooms have inadequate sensible gain and consequently inadequate dehumidification are during the cooling season whenever the outdoor temperature is at or above room temperatures, except in localities or during hours when the outdoor conditions are comparatively dry. This occurs in the following exposures:

a) North facing rooms except during a few midsummer early morning and late afternoon hours when there is some sun gain on these north rooms (north of the equator).

b Any room which is shaded from the sunshine at any time or when the sun is not shining.

c) All rooms between sunset and sunrise.

d) East and south rooms when the sun is in the west.

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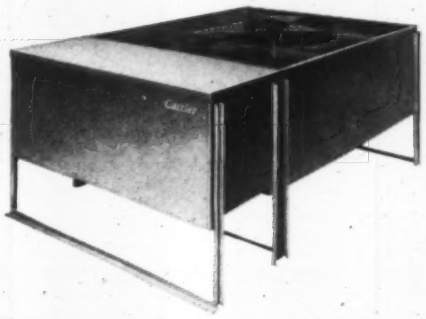
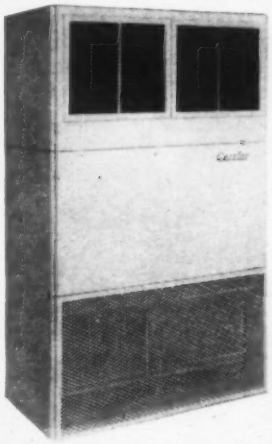


OUTDOOR UNIT



INDOOR UNIT

PRACTICAL EVEN IN COLDER CLIMATES!

Carrier 10 and 15 ton Heat Pump Weathermakers

These new Carrier two-piece Heat Pump Weathermakers* offer many advantages for heating and cooling factories, department stores, theaters, banks and restaurants. Their improved design, combined with the heat load from concentrations of light, people or machinery, makes it possible to operate them as economically in colder climates as many types of conventional systems.

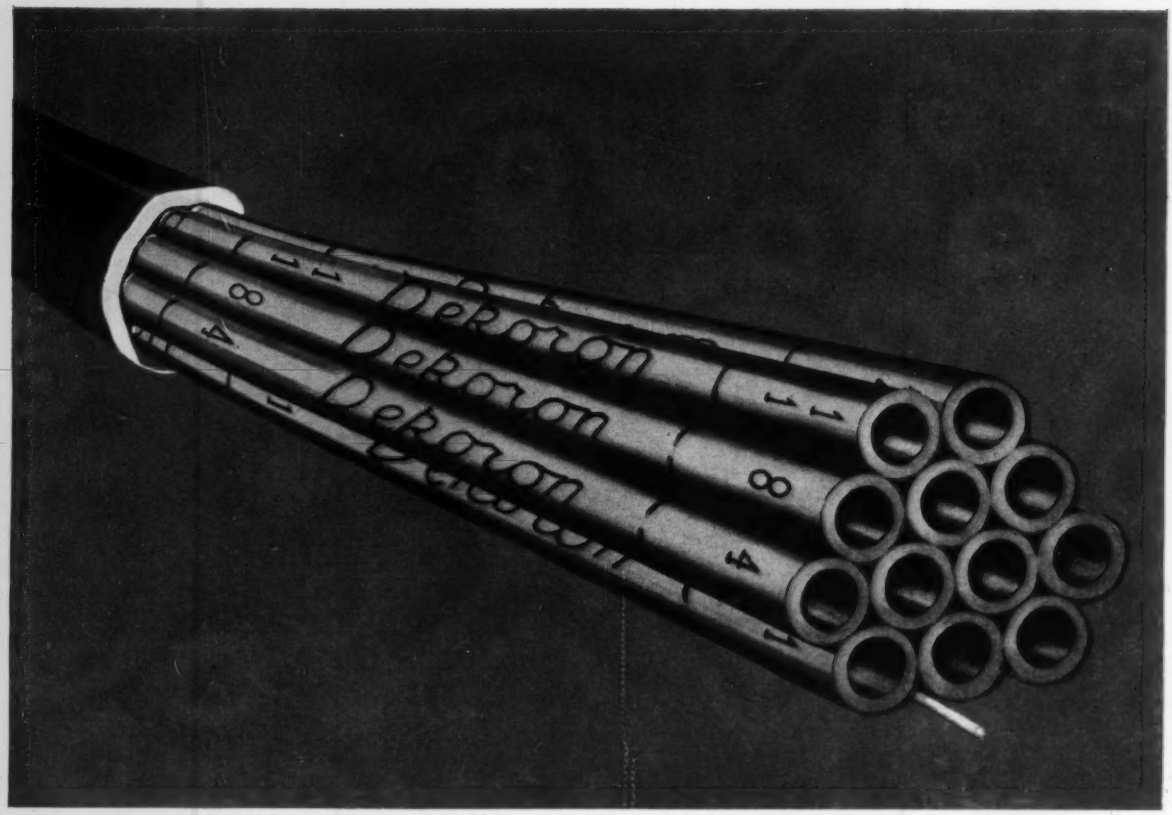
An all-electric, air-cooled system, the Carrier Heat Pump Weathermaker requires no combustion fuel in winter and no water in summer. And because a single system handles both cooling and heating, there is an overall first-cost savings for many new buildings . . . as well as complete elimination of the normal expense resulting from seasonal start-ups and shutdowns. There is also space saving through the elimination of a boiler, smokestack, water tower and fuel storage facilities.

To meet installation requirements, this two-piece Weathermaker offers a wide variety of arrangements. The indoor section may be suspended horizontally or vertically. Vertically, it may be hung from a wall or it may stand on the floor. Air distribution may be through ductwork or accessory plenum. The outdoor section, with its extremely low silhouette, makes it ideally suited for rooftop installation.

Your Carrier dealer, listed in the Yellow Pages, will be glad to give you complete information about these efficient, economical new 10 and 15 ton Heat Pump Weathermakers. Or write Carrier Air Conditioning Company, Syracuse 1, New York.

*Reg. U. S. Pat. Off.

Carrier Air Conditioning Company



New Dekoron instrument harness design uses core of Anaconda precision copper tubes

The new parallel-construction Dekoron* "Metl-Cor" instrument harness offers many interesting features. All the tubes are number-coded for faster installation. Because the tubes are parallel, there are no low spots or moisture traps – and as tubes need not be straightened, take-offs are easier to make. The tubes are protected from corrosion and physical damage by a sheath of improved polyethylene. New Dekoron "Metl-Cor," a product of Samuel Moore & Company, Mantua, Ohio, is available in lengths up to 1000 feet.

In this new product, as in other Dekoron instrument tube bundles, Samuel Moore & Co. uses Anaconda Copper Tubing because it consistently meets its rigid quality requirements and is available in unusually long lengths. Special care is taken by Anaconda to maintain dimensional accuracy and uniform soft temper throughout the length. It also makes sure that surfaces are clean, smooth, and bright, free from dirt, dust, or metal chips.

LONG LENGTHS. For such uses as in instrumentation, Anaconda can produce this precision copper tube in coils up to 2200 feet for ¼" O.D.–up to 1400 feet for ⅜" O.D.–and up to 1000 feet for ½" O.D.

QUALITY TUBE AND CREATIVE TECHNICAL SERVICES. Whatever your requirements for precision copper tubing-instrumentation or capillary tubing, or restrictor tubes – Anaconda specialists can help you find the most economical way to do the job. For such technical assistance, see your Anaconda representative, or write: Anaconda American Brass Company, Box 1031, Waterbury 20, Connecticut.

*Registered trademark of Samuel Moore & Co. 6070

ANACONDA®

INSTRUMENTATION TUBING

Anaconda American Brass Company

"Open for Discussion"

Continued

e) West and south rooms when the sun is in the east.

f) East and west rooms when the sun is in the south.

g) Rooms without windows, if any. These rarely occur.

The ventilation rate of the fan-coil units system is the poorest of all systems considered. The provision of an opening in the wall to such units for introduction of outdoor air for ventilation dilution is the poorest possible method.

The amount of air passing through these openings is completely unpredictable. It is dependent upon wind velocity and direction, stack effect of the structure, relation of exhaust volume to supply air volume in the structure, relation to the intermittent operation of various supply and exhaust systems of the building and whether room doors are open or closed.

It is entirely possible to have air *exhausted* out of these openings on the leeward side of a structure with even normal wind velocities. It is possible for air to be exhausted out of these opening located on all levels above the midpoint of the height of the structure in the winter, due to stack effect as well as the reverse effect from the lower levels in the summer. It is possible for more than the designed outdoor air rate to be introduced through units on the windward side of a structure, through all units if the structure has an excess of exhaust fan installation, and through units at levels which have a negative pressure in relation to out-of-doors due to stack effect conditions.

Noise level of these units as Mr. Holbrook stated is higher than is generally considered desirable.

The maintenance of fan coil units is extensive and complicated. Most institutions which have such units do not adequately maintain them. This system with or without a primary conditioned supply air system in conjunction with it, is somewhat more difficult to operate than other systems. During the in-between seasons when changeover from heating to cooling and vice-versa is required, such systems are too often operated improperly.

Fan Coil Units With Primary Air

The use of the fan coil units system should not be considered for hospital patients' rooms unless it is accompanied with a conditioned primary air supply system to each unit. Only in conjunction with a conditioned primary air supply to each fan coil unit can the system be thermodynamically correct for all exposures at all times, provide adequate dehumidifying in the summer, humidity in the winter and a positive ventilation or air change rate of adequately conditioned and filtered outdoor air at all times.

Induction Units System

1) With the exception of the complexity of the in-between season changeover problems of operating and maintenance, similar to the fan-coil units system with primary air, the induction units system provides complete year 'round air conditioning on a satisfactory basis.

2) Control of humidity or dehumidity for this system is not quite as Mr. Holbrook infers. He states that, "terminal humidity can be closely controlled." This infers that humidity or dehumidity of each space can be closely controlled. This is not true because the final room humidity or dehumidity is a factor of the primary air dew point temperature in relation to the latent gain in each room, which can and does vary. The control of humidity or dehumidity in this system is on a zone basis like any central system, and not on a room basis as is suggested. The central system portion of this method is the primary air system.

Double Duct System

1) Individual room control requirement is satisfied with this system.

2) Control of humidity in winter and dehumidifying in summer can be satisfied with this system.

3) Positive ventilation rate is satisfied with a properly designed double duct system.

4) The noise level of these systems is usually higher than that of conventional velocity central systems or induction systems and quite often undesirable.

5) If properly designed the operation of the system is relatively simple. Maintenance of sound attenuators and complicated mixing control boxes can be extensive.

6) This system usually is more expensive to install than other complete year 'round systems. It is also more expensive to operate because of the high fan hp which for patients' sections of hospitals requires a 24 hour, 365 day per year operating period.

WILLIAM STURM
Chief Mechanical Engineer
Ellerbe and Company
Architects and Engineers

Disagrees With Remarks on Fan-Coil Systems for Hospital Air Conditioning

CONGRATUATIONS are in order to John A. Holbrook, of the A. T. Kearney Co. for his article *Hospitals: A Challenge to Air-Conditioning Engineers* in the January issue.

In discussing fan-coil units for this type of installa-

Continued on page 102

"Open for Discussion"

Continued

tion, Mr. Holbrook has, however, failed to emphasize one of the most important characteristics of fan-coil units; that is, they do not mix air between rooms. This is a tremendous advantage available for a fan-coil system in a hospital because of present thoughts on transmission of bacteria.

I should like to take issue with the author's statement that the single coil cannot carry the heating load and that a radiator or convector must be installed in the majority of cases. In the many installations with which I am familiar, the heating capacity of the fan coil unit far exceeded the load requirements when the fan coil unit was selected to satisfy the cooling requirements. In many installations it is necessary to operate the fan at high speed during the cooling season and at low speed during the heating season to prevent overheating of the room.

The noise from a properly designed fan-coil unit, properly installed, is usually less than the noise from the compressor of a package unit or from the nozzles in an induction unit.

GEORGE S. DIEHL, JR.
Product Sales Manager
Air Conditioning Div.
Worthington Corp.

THE AUTHOR'S REPY — The comments of Robert Flanagan, William Sturm, and George S. Diehl, Jr. are all very appropriate. In general, I find no quarrel with their statements.

The purpose of this article was to summarize the characteristics and make comparisons of the various types of systems commonly found in or proposed for, hospitals. The desirable characteristics of a hospital air conditioning system are enumerated at the start of the article and from the engineer's viewpoint these requirements should be rigidly adhered to.

For the hospital administrator's or the owner's experience, the situation is somewhat different. Many systems are in use today that are not up to present day engineering standards. However, they serve a purpose and will be brought up in many architect-owner, engineer-owner discussions. They were included here to complete the picture, not to present a case for their consideration.

Noise levels and easy access for maintenance are features that should not be overlooked in designing any air conditioning systems. The comparison of the various methods was based on the assumption of satisfactory engineering design. Any of the systems discussed could be made up of improperly selected equipment which could be extremely noisy or could be so oriented that service accessibility would be a real problem. I certainly agree with Mr. Sturm that noise levels and ease of maintenance should be considered in hospital air conditioning design.

Mr. Diehl's comments on cross contamination and supplementary heating have been reviewed and were considered when the article was prepared. The effectiveness of patient room isolation with a fan-coil system is partially dependent upon the outdoor air makeup and exhaust air systems. If both of these systems are properly designed and operated, patient room isolation will be excellent.

Generally speaking, the coils in fan-coil units will have more than adequate heating capacity if an all air heating system is to be used. However, in many cases it is desirable to have radiation available in the patient room to offset the perimeter effect. Mr. Diehl is right, the capacity is more than adequate but I still prefer to have the radiation and operate the system as a combination one.

JOHN A. HOLBROOK
A. T. Kearney & Company
Management Consultants

Industrial Air Conditioning Job Looks Well Planned, Engineered

AFTER carefully reading the article, *Air Conditioning for Light Industry*, in the February issue, I am of the impression that the installation is well engineered and should be quite satisfactory.

In reference to the second paragraph on page 104 it states there is a low limit thermostat to halt the fan when leaving air temperature is below 60 F. I assume that this refers to an outside air fan.

I note that in the next paragraph it mentions that the supply air blankets the perimeter of the hood at a volume great enough to prevent the escape of any fumes.

This appears to be a very good method of containing the fumes and goes along with the increasing use of establishing effective barriers with air curtains.

C. F. MOWREY
Project Engineer
LJED Facilities, Plant Engineering
Flight Propulsion Div.
General Electric Co.

How Wise Is Overhead Equipment Location for Shop Air Conditioning?

I HAVE READ the article, *Air Conditioning for Light Industry* (February), and I find it is always encouraging to learn of a new industrial plant which has been given good emphasis for heating, ventilation, and, above all, a step forward with shop air conditioning. Immediately, we have to assume that the featured plant could justify the premium for shop air conditioning on the basis of product manufacture. As to the equipment arrangement, we form

Continued on page 106

YOU GET ALL 3

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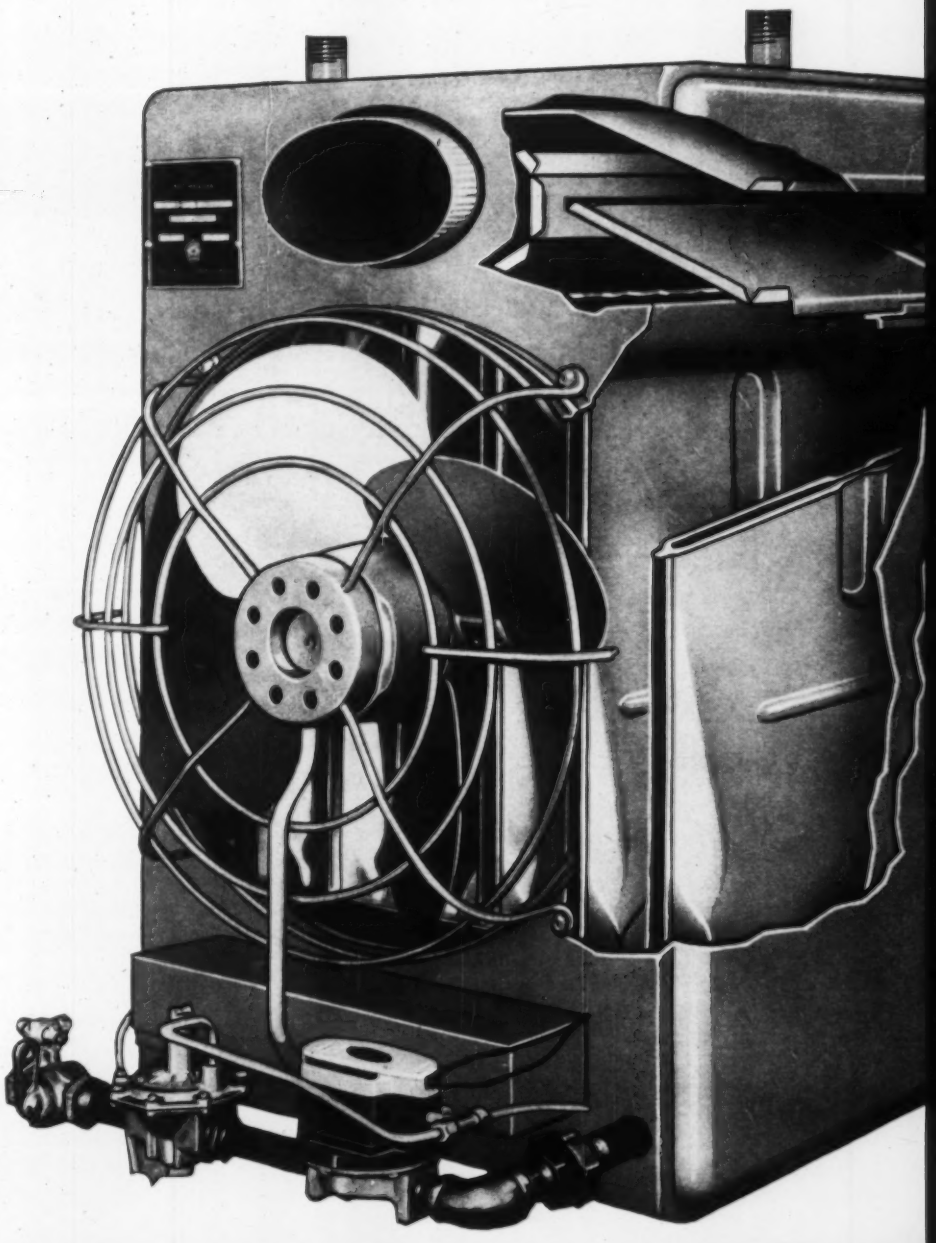

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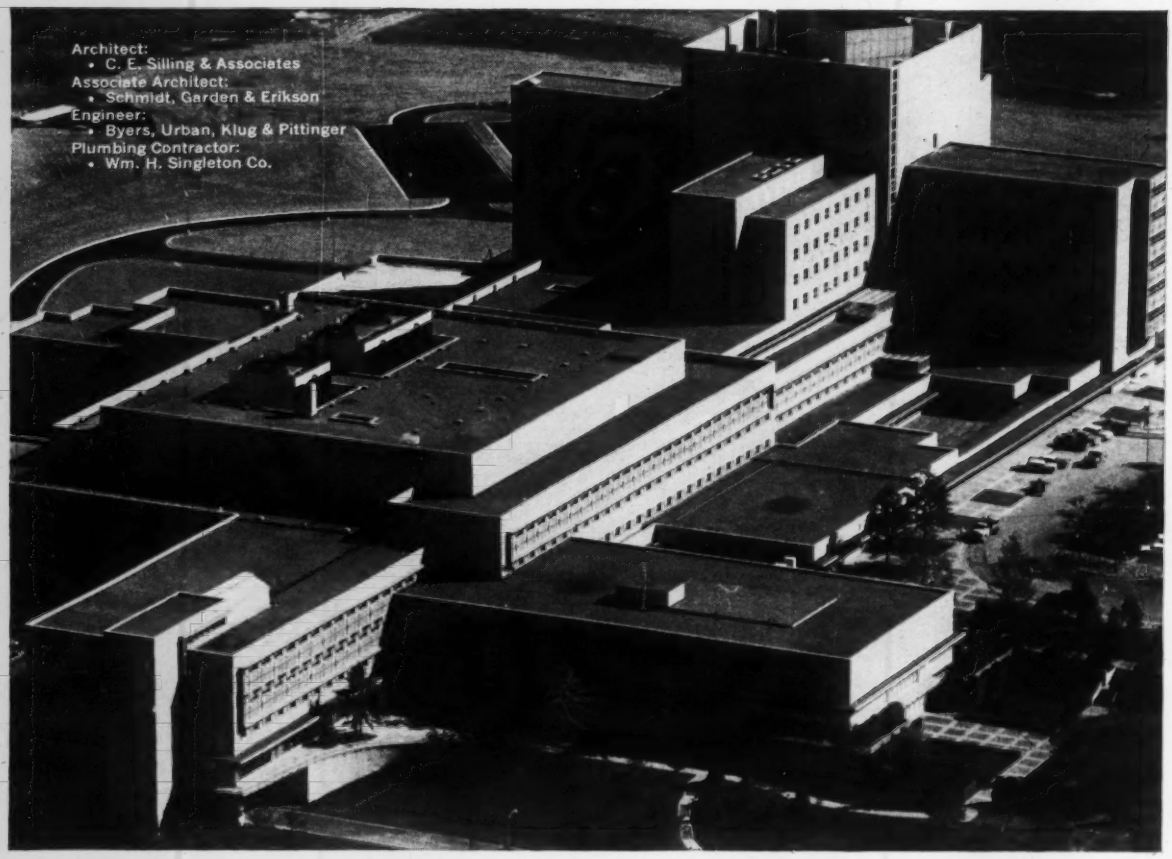
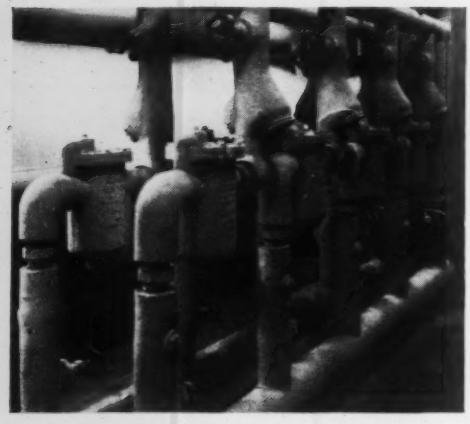
Unit Heaters



Steel pipe will sustain essential services for generations in this center of healing arts



Mile on mile of steel pipe relays essential services from central sources to every working area, every room, every nook and cranny where these services are needed.

Here—in the West Virginia University Medical Center at Morgantown, W. Va.—hospital and research facilities are combined into one efficient, complex of inter-related buildings. Wisely the people of the state are providing for the health of its residents and are contributing to the nation's overall program for combatting and preventing diseases of body and mind.

Steel pipe does much to help make this outstanding Medical Center modern, comfortable and efficient. *Steel pipe* provides water, heating, refrigeration and fire protection systems; vents and drains away waste—in short, delivers the everyday essentials. Rigid steel conduit carries electrical and communications wiring. And *steel pipe* and rigid steel conduit will continue to deliver these services for many generations to come.

Yes, *steel pipe* is dependable and durable. It's formable, weldable and suitable. And it's low in cost. In fact, for carrying fluids, snow melting, radiant and conventional heating, refrigeration, vent and drainage lines and many other applications—*steel pipe* is the most widely used pipe in the world.

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C-11

"Our original 30 units have now been operating for three years without a single service call. I personally don't see how anything can be made better."

Phil Empey, Managing Owner
EMPEY'S DESERT VILLA

No wonder Phil Empey again chose MARLO SEAZONAIRES for his new Desert Villa Addition

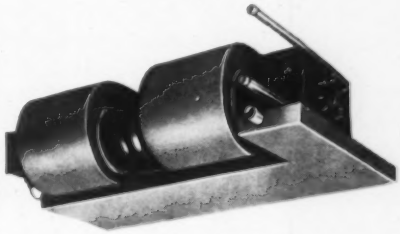
When Phil Empey recently expanded his plush Desert Villa Motel on the famed Las Vegas "Strip", he chose Marlo Seazonaire remote room units to comfort condition the new 39-room addition.

Why? Because of his overwhelming satisfaction with the 30 original Seazonaires which have been serving the Desert Villa for the past three years.

Mr. Empey expresses himself with unconcealed enthusiasm about their quiet operation, and particularly their trouble-free, service-free reliability.

Seazonaires lend themselves beautifully to motel air conditioning and other multiple-room installations. They can be individually regulated in each suite, and require no expensive, space-consuming ductwork — only simple piping for chilled or heated water. They can be floor mounted or ceiling mounted, exposed or recessed (Mr. Empey selected the ceiling mounted recessed model).

Bulletin 35 contains complete information about Marlo Seazonaire units. Write for your free copy, or contact the Marlo representative in your area.



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"Open for Discussion"

Continued

the opinion that this is a good conventional type job, but we did not detect much actual innovation.

In the way of constructive criticism or expression, we believe that the plan of locating equipment inside the building near the roof line (above truss bottom) is a scheme which will bring about some regret to the owner, because we have experienced many problems with this same situation — chiefly, inaccessibility, stratification involvement, air distribution obstruction troubles, etc. We also have the opinion, whether it be right or wrong when all local factors are considered, that this building might well be "over equipped" and that new design self-contained package heating and air conditioning units may have proven more economical initially and certainly in the long pull.

JOHN VONDERHEIDE
Manager — Plant Engineering Relations & Utilities Operation
Major Appliance Div.
General Electric Co.

Consider Resorption Cycle System For Solar Air Conditioning

THE ARTICLE, *Tests Prove Feasibility of Solar Air Conditioning*, by Melvin Eisenstadt, F. M. Flanigan, and E. A. Farber in the November 1960 issue was timely and interesting. The work done by these investigators and others in the field confirms the practicability of utilizing energy from flat-plate collectors in an absorption refrigerating machine.

My own studies have led to the same conclusion. I believe, however, that an ammonia-water system using the resorption cycle shows more promise than the conventional absorption system.

Second Absorber Replaces Condenser

The resorption cycle differs from the absorption in that the conventional condenser is replaced by a secondary absorber, or resorber, and the evaporator is replaced by a secondary generator operating at low temperature and pressure. A secondary aqua-ammonia solution is circulated through these two components in the same manner in which the primary solution is circulated through the conventional generator and absorber. Thus the solution changes in both concentration and temperature in the four pressure-vessels comprising the system.

It may be seen that the conventional absorption system is a special case of the resorption system, with 100 percent concentration in the resorber (condenser) and evaporator. By properly selecting the concentrations in the generator, absorber, resorber, and evaporator, the machine may be operated with input and output temperatures at various levels within a fairly wide range.

Chief advantage of the resorption cycle lies in its ability to produce greater refrigerating effect with a lower generator pressure while using cooling water at the same temperature, as compared to the absorption cycle. The lower generator pressure allows the use of a lower-temperature heating fluid, which is highly desirable when flat-plate solar collectors are used as the heat-source.

Need Two Pumps, Heat Exchangers

The disadvantage of the system is the need for two solution pumps and two heat inter-changers rather than one of each as in the absorption system. However, there is some compensation for the added equipment cost in the lower pumping heads and in the fact that counter-flow heat exchange may be used, due to the changing temperatures in the evaporator.

With normal cooling water temperatures and a generator temperature of 180 F it is entirely practical to maintain the evaporator temperature at ice-making levels, thus affording an efficient means of storing refrigeration for use at night and during cloudy periods.

Costs Should Be Favorable

The original cost of a well designed resorption machine; aside from the flat-plate collectors, should compare favorably with today's conventional air conditioning equipment. Many refinements are possible to lower equipment costs. For instance, the aqua-ammonia could be pumped directly through the solar collectors and discharged to a flash tank for vapor separation, thus eliminating the shell and tube generator and lowering heat-exchange losses.

System May Heat, As Well

An interesting side-light is the possible use of the same machine for space heating in winter. The heat rejected from the absorber and resorber is approximately 200 percent the heat input to the generator. Thus, the winter output of the solar collectors could be doubled, at the price of lower temperatures, say 80 F or 90 F.

In short, the resorption machine seems to offer unique possibilities for the efficient use of solar heat.

It would be interesting to have the findings of other investigators in this field published from time to time in Heating, Piping & Air Conditioning.

IRBY HICKS
Refrigerating Engineer

a new line of Bulletin 709 motor starters by ALLEN-BRADLEY

- smaller size
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- even more millions of trouble free operations
- more wiring room
- elegant styling
- A-B "quality" throughout

A "family" of 7 starter sizes ... each one entirely new

greatest advance in motor control in 30 years

In appearance . . . in performance . . . in physical size and weight . . . these Allen-Bradley Bulletin 709 solenoid starters are *completely new in every way!*

NEW COMPACTNESS. Size reductions are so drastic you'll hardly believe your eyes. The tables below will give you some idea of how the new line of Bulletin 709 starters compares with the old.

A TREMENDOUS INCREASE IN LIFE—both mechanical and electrical. All of these new starters are good for many more millions of trouble free operations.

NEW PATENTED MAGNET. For its weight and size, the most powerful magnet used on motor control. Its short, cushioned stroke assures long contact life. A new, permanent air gap prevents any possibility of magnetic sticking. "Snap action" guarantees positive contact opening and closing.

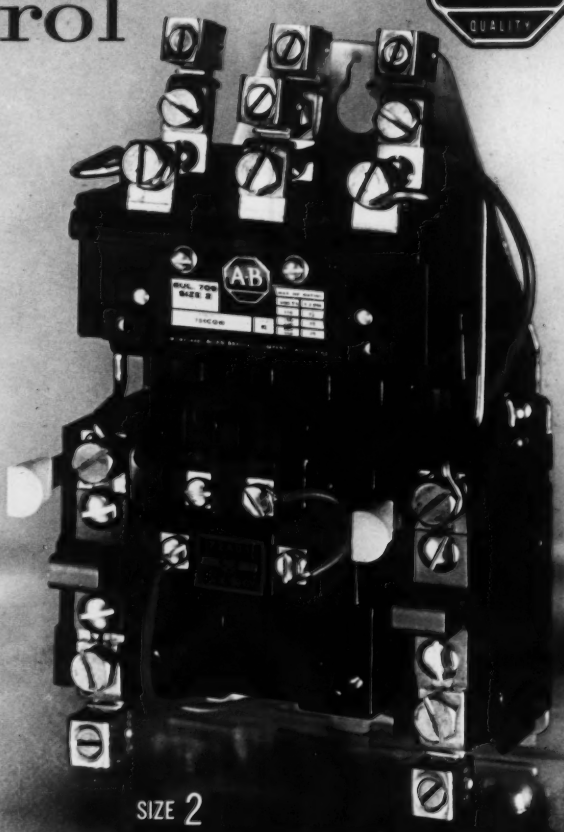
NEW MOLDED COIL. Impervious to atmospheres that could cause trouble, and also protected against mechanical damage. All coils are easily removed—from the front of the starter.

NEW CONTACTS. New double break contacts of cadmium oxide silver resist welding . . . close and seat firmly without sliding or wear-causing motion.

NEW OVERLOAD RELAYS. Not only "trip-free" but also "tamperproof," to reliably protect motor and machines. Of course the new relays were designed to use the old Bulletin 709 heating elements which you have in stock.

NEW ENCLOSURES. Completely restyled by Brooks Stevens—and so modern. They are a sales asset on any type of modern machine or industrial installation.

BETTER WRITE FOR MORE INFORMATION ON THIS REVOLUTIONARY NEW BULLETIN 709 STARTER!



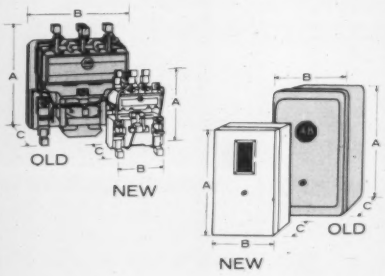
SIZE 2

New Bulletin 709 Solenoid Motor Starter

CHECK THE "NEW" WITH THE "OLD" BULLETIN 709 DIMENSIONS

The wiring room in the new enclosures will delight the electrician.

Starter Size	OPEN TYPE STARTERS					
	NEW			OLD		
	Height A	Width B	Depth C	Height A	Width B	Depth C
00	3⅝	3⅞	3⁹⁄₁₆	—	—	—
0	5⅞	4¹⁄₁₆	3¹¹⁄₁₆	5⅝	4¾	3¼
1	6⅝	4½	3¹¹⁄₁₆	5⅞	5	3¼
2	7¾	4⅝	3¹¹⁄₁₆	10¹⁄₁₆	5¾	4⁷⁄₃₂
3	10¼	6¼	5⁷⁄₁₆	12⅝	7¼	5⅞
4	11⅞	7⁵⁄₁₆	6¼	16¼	12¾	6¹³⁄₁₆
5	14¹³⁄₁₆	9	6½	20	16⅛	8¾



Starter Size	NEMA 1 ENCLOSURES					
	NEW			OLD		
	Height A	Width B	Depth C	Height A	Width B	Depth C
00	7⅝	4⅞	4¼	—	—	—
0	9⅛	6⁵⁄₁₆	4⅜	7⅞	5⅝	4¼
1	10	6¹³⁄₁₆	4⅜	8¹³⁄₁₆	6⅜	4¼
2	12	7⅝	4⅜	14½	9	5⅞
3	16⅝	10⅜	7	19½	11⅜	6¹¹⁄₁₆
4	22	11⅝	8	26⁹⁄₁₆	14¹³⁄₁₆	7¹¹⁄₁₆
5	32¹³⁄₁₆	17¹³⁄₁₆	9⅞	41½	19¹³⁄₁₆	13¹³⁄₁₆

8-61-RM

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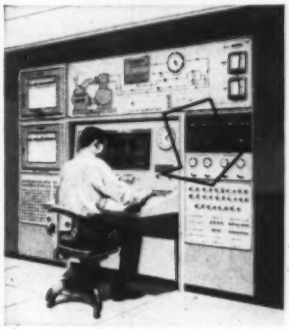
Compare Honeywell's latest air cleaner advances

Exclusive Flutter-Jet* washing solves the problem of cleaning air cleaners

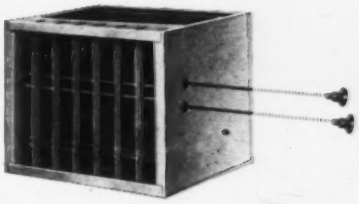
Honeywell's new Flutter-Jet washing system sweeps away collected dirt with a powerful stream of water. Its flexible rubber nozzle keeps water in larger droplets as it strikes the surface, assuring greater washing action. Attached to a moving manifold, it covers the entire area. It requires as little as 20 pounds of water pressure, and can't be clogged by salts or other impurities in the water. Flutter-Jet washing prevents breakdowns, reduces maintenance and increases efficiency.

Exclusive power safety system saves steps, assures maximum protection



A direct current sensitive relay in Honeywell's new power safety system makes it possible to control the power supply from a remote location. This permits the system to be reset without losing time going to the equipment itself. This new relay also enables you to hook the system up to a centrally-located alarm panel (see illustration), where an audible or visible alarm will be answered immediately. By providing a continuing check on equipment, it assures maximum protection and top operating efficiency at all times.

New intercell button connector cuts field installation time



Never before has it been so easy to make the electrical connections between cells. And this spring loaded ball and socket arrangement—less than 3 inches in diameter—is completely waterproof. Best of all, it features a plastic sealing ring of high dielectric strength that prevents loss from arcing as current flows between the cells. The new intercell button connector cuts installation time considerably and makes dismantling for service a snap.

New power pack features oversized selenium rectifiers for longer life

New oversized selenium rectifiers give this power pack greater dependability and a longer life. These solid-state rectifiers help stabilize the current output and maintain a constant peak inverse voltage. They are also mechanically shock resistant—a great advantage in shipping and handling. The power pack itself provides dual voltage for higher efficiency—90% at an air flow of 500 feet per minute.

Now you can specify the Honeywell Electronic Air Cleaner with even greater confidence. And only Honeywell gives you complete service back-up. Honeywell field engineers will supervise the installation, check out the equipment once it has been installed, and train the men who operate it. And an exclusive Honeywell maintenance contract assures your client maximum cleaning efficiency—through periodic inspections—for the life of the system. For details, call your nearby Honeywell office. Or write Honeywell, Dept. AC-4-111, Minneapolis 8, Minnesota.

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question of the month

"Can No. 6 Fuel Oil Be Used for Heating Large Installation Where Constant Modulation Is Required?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with two answers that have been received from readers. Additional answers were presented in the March issue. Other solutions or comments for publication are invited.

"I am preparing a design for a new heating system for our plant, and will use unit heaters and convectors with hot water at a pressure of 50 psi and temperature of 300 F.

"The estimated capacity required will be 10 million Btu per hr. It is proposed to use two oil fired boilers of equal size, with a combined output of 12 million Btu per hr. The fuel being considered is a No. 6 fuel oil, with a viscosity of 3500 Saybolt seconds.

"The burners will have to be modulated constantly to satisfy the variable heating load, and I am wondering if it is wise to consider such a heavy oil for this purpose. I realize that No. 6 fuel oil will require preheating prior to combustion, but the operating cost with No. 6 oil will be considerably lower than with lighter fuels.

"I would like to hear from other readers of Heating, Piping & Air Conditioning about this and learn what their experiences have been with No. 6 fuel oil for large installations of this type." — R.A.W.

If Equipment Can Handle Fuel, Costs Will Decide The Issue

TO ANSWER the question "Can No. 6 fuel Oil Be Used for Heating Large Installation Where Constant Modulation Is Required?" one must first ask "What is the magnitude of the constant modulation?"

If the modulation or load fluctuation does not exceed 45 percent of rated load, the automatic controls should handle it. If it goes much above 55 percent, it may require some manual adjustment.

In 1949-50, the University of Oklahoma constructed a new power plant, equipped with two 50,000 lb per hr boilers operating at 425 psi with superheat. These were intended to be fired by either natural gas or No. 6 fuel oil. Gas was used basically. However, in order to obtain a favorable gas rate, it was necessary that we be able to switch to the other fuel within an hour's notice. The burners were designed for either fuel, making it possible to switch over quickly.

The University of Oklahoma's load is also a greatly fluctuating one. However, the burners and controls have been able to handle the situation. Since we generate our own electric power, it is important that we have near-constant steam pressure.

It is my opinion, based upon my interpretation of the question, that with proper equipment the plant could be successfully operated on No. 6 fuel oil.

Table 4 of Chapter 33, p. 484, of the ASHRAE Guide (1960) gives information concerning the several grades of generally used fuel oil. No. 2 and No. 6 oils are in greatest demand. No. 2 is used largely for domestic purposes, and No. 6 largely by industry. No. 4 fuel oil is an intermediate grade having higher flash point and greater calorific value than No. 2.

The following relationships must also be considered in view of the need for economy.

A cost comparison for these three fuel grades at our location (for tank car delivery, F.O.B. Oklahoma City) shows No. 2 oil at 9-3/4¢ per gal, No. 4, 7-3/4¢ per gal, and No. 6, 5-1/2¢ per gal.

The calorific values for the three fuels (average) are, No. 2 at 140,050 Btu per gal; No. 4 at 149,000 Btu per gal; and No. 6 at 152,850 Btu per gal.

Continued on page 112

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JAMES P. BOYLE
ASSISTANT SALES MANAGER

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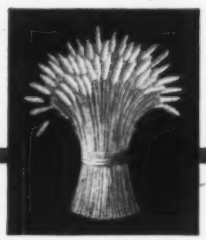

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API LINE PIPE IN ACCORDANCE WITH AMERICAN PETROLEUM INSTITUTE SPECIFICATIONS

question of the month

Continued

Finally, as regards handling costs, No. 2 fuel oil will require no heat for handling, nor will No. 4 fuel. No. 6 fuel will require heat for unloading to the storage tank, transfer line heat up to 160 F, at 95 F temperature in the storage tank, and heat at the burner from 180 to 200 F.

Therefore, it must be remembered that while No. 6 fuel has the largest calorific value and the lowest F.O.B. cost, it is necessary to heat it, from tank car to storage and thence to the burner, because of its high viscosity.

When installations are properly equipped to handle No. 6 fuel oil, however, this is more economical fuel for moderate to large heating requirements.

WALTER W. KRAFT
Builders Construction Co.

Temperature-Viscosity Relationships, Burner Types Must Be Considered

IN THE *Question of the Month*, January, R. A. W. describes an oil-burning system requiring constant modulation and asks if No. 6 oil will be a satisfactory fuel.

He mentions oil viscosity as 3500 SSU, which is typical for No. 6 at 100 F. Pumping temperature should be between 90 and 100 F, giving viscosities of approximately 5000 to 7000 SSU.

Oil atomization requirements are governed by burner type and fuel properties. Table 1 lists typical data. Exact values are influenced by the source of crude as well as methods of refining and blending. Viscosity-temperature relations for each fuel shipment should be established to prevent overheating. The latter may cause solids contained by the oil to come out of suspension, leading to rapid fouling of equipment.

Good burner performance prevails when the oil is maintained at nearly constant viscosity. The latter may be had if the fuel is heated to a value where moderate temperature changes have little effect upon viscosity.

A plot of the typical temperature-viscosity relations shows that in the high temperature zone, small variations in viscosity occur during relatively large temperature changes.

Choose Burners for Oil Type

With the trend to lower quality fuels, R. A. W. should consider selection of burners designed for these adverse conditions. In addition to viscosity, sulphur content and heating value are other important factors. Discussions with the petroleum companies will help provide this information.

Choice of burner type should be governed not only by economics, but also by mode of operation. The two principal designs are mechanical and steam atomizing. Table 2 gives a brief comparison of their respective features.

Type, size and number of burners are influenced by load range and furnace design. A multiple burner installation provides more uniform heat flux and better temperature control at varying outputs. As an example, one burner having a maximum output of 40 gph and a turndown ratio of 5 to 1, offers maximum and minimum flow rates of 40 and 8 gph, respectively. For these same conditions, use of two 20 gph burners allows cutting out one unit at low loads, providing a turndown ratio of 10 to 1.

H. B. WAYNE
Consulting Engineer

TABLE 1 — OIL ATOMIZATION requirements are governed by type of burner used, as shown by variation in data for mechanical, steam atomization

Atomization requirements	Mechanical Atomizing	Steam Atomizing
Turndown ratio	3 to 1	5 to 1
Viscosity at burner, SSU	150 to 180	180 to 200
Atomizing temperature, F	160 to 250	160 to 185
Oil pressure at burner, psi	50 to 250	2 to 125

TABLE 2 — COMPARISON of mode of operation for steam and mechanical atomizing burners is shown at right

Mechanical Atomizing	Steam Atomizing
Requires nearly steady load operation	Better for variable loads
Frequent cleaning necessary	Less frequent cleaning needed
Higher atomization temperature needed	Lower atomization temperatures
High oil pressure necessary	Lower oil pressure
Very sensitive to viscosity variations	Less sensitive
Does not require atomizing steam	Requires atomizing steam
Higher air pressure needed	Higher air pressure unnecessary
Greater installed cost	Lower installed cost

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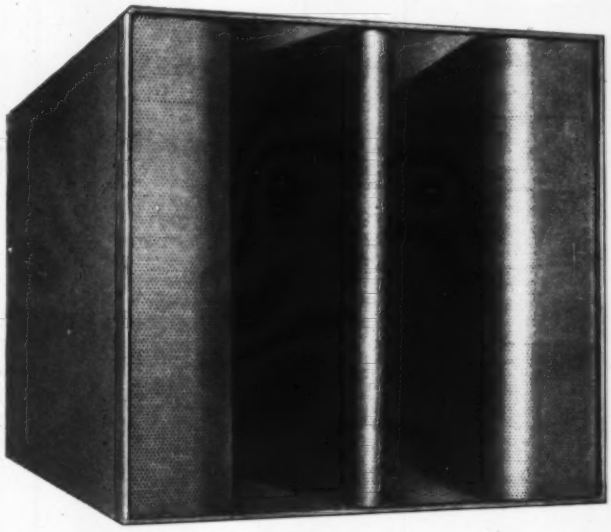

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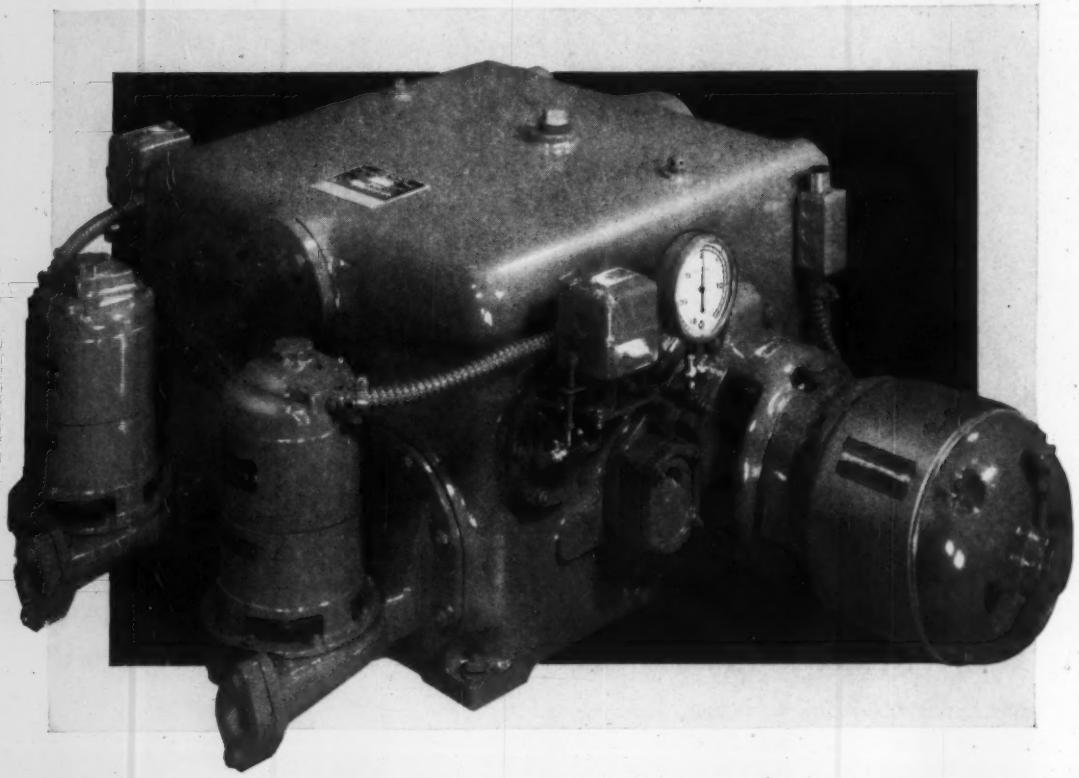

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● For many years, the general upward trend of building costs has meant that air conditioning design engineers have been faced with increasingly urgent demands to economize in system design — not only in initial and operating costs for the equipment itself but in the amount of space used in supplying conditioned air. Imaginative solutions to space and cost problems have been demonstrated in our pages many times. This article details the air conditioning system developed for a building constructed during the late 1930's and a new system installed in a recent sizeable addition. It is then a double demonstration — showing not only how acute these problems have become, but also how careful analysis and planning can still yield a full return within the budget.

Air Conditioning Design Beats Cost, Space Problems

By ROBERT W. FLANAGAN
Mechanical Engineer
Daniel B. Stevenson, Jr.
Consulting Engineer

THE PURPOSE of this article is to illustrate some of the marked changes taking place in building space requirements and costs, and to show how these changes have affected the design of large building heating and air conditioning installations.

For many years the general level of building costs has been rising; so much so that equipment room space and equipment installation costs are becoming of ever greater concern to everyone involved.

Heating and cooling loads per sq ft of building area are increasing year by year, but the space allowed for equipment rooms, duct shafts, etc., is necessarily being reduced because of costs.

Consequently, if the design engineer hopes to provide the owner with a satisfactory year 'round air conditioning system without destroying the budget, he must now more than ever concentrate on an analysis of all aspects of the system design.

Iowa Building Provides Good Example

The Bankers Life Co. home office in Des Moines, Ia., is a somewhat typical example of a large deluxe office building constructed during the late 1930's. The structure has been expanded by some 47 percent with the completion of a recent addition.

Both the original and new wings are completely air conditioned. The immediate difference is that the old was built during a period of low construction costs (1938-1940), and the new during a time of record high costs.

Table Compares Old and New

Relative size, space allotments, equipment capacity, and costs for the original structure and addition are compared in Table 1. Figs. 1 and 2 show an elevation of the integrated structure and a typical floor plan respectively.

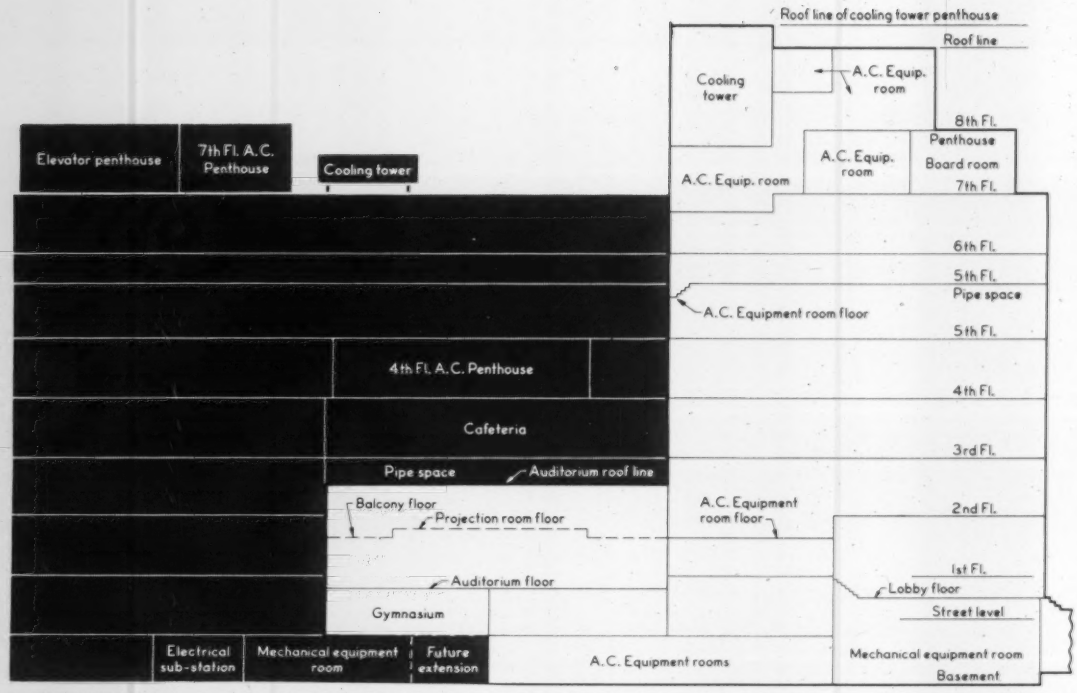
Now let us see how the air conditioning design had to change with the times.

The original Bankers Life Co. building consisted of six office floors above grade, a seventh floor board room and penthouse, eighth floor penthouse, a ground floor for offices and storage, and a basement area for boiler room, refrigerating equipment room, work shops and additional storage.

Besides these areas, there were also included a fifth floor pipe space 8 ft in height, plus a basement gymnasium with a 7800 sq ft auditorium above.

Incorporate Advanced Design Features

At the time of construction, several aspects of the design were most advanced. Almost 35 percent of the exterior walls were of glass or glass block. There was no exposed heating system in the office areas. The metal panel interior surfaces were separated from the exterior walls by a 5 in. air space, in which was



1 ELEVATION shows new wing and cafeteria floor in gray. Mechanical equipment room for addition provides space for more equipment when building is expanded again

installed a copper pipe system. The pipes are supplied with hot water during periods of heat loss and chilled water when heat gain would occur, thus creating a "neutral wall" which is zoned by exposure.

This has proven to be an excellent feature. The only exception to the application is on the sixth floor, which is heated and air conditioned by an all-air window stool distribution system with reheat coils located in the fifth floor pipe space.

Use Spray Washer Central System

The basic design of the original building air conditioning installation is that of a built-up central station spray washer type system which supplies air to eight built-up recirculating air systems.

The recirculating air handling units mix varying amounts of dehumidified air, cooled by means of chilled water from basement compressors, with reheated return air under control of a zone thermostat. A separate hot water reheat coil is located on the suction side of the supply fan in each of the recirculating units. Vortex dampers on the main dehumidified air ducts modulate under control of discharge air static pressure regulators.

Supplementary to this main system, three other central station units located in other parts of the building supply air directly to the zones which they serve. These systems are of 10,400; 12,400; and 22,000 cfm capacity respectively, while the main unit dehumidifier will handle 112,000 cfm. The eight recirculating fans increase the total capacity of the prime system by 218,600 cfm.

Finally, two air handling units with chilled water coils supply cooled air to the basement storage area. All of these systems provide year 'round temperature and humidity control, and are of excellent design.

The air handling apparatus is located in various equipment rooms throughout the building (Fig. 1). The water chilling equipment consists of two 260 ton capacity reciprocating compressors, plus a 130 ton unit, each driven by a 4000 v synchronous motor. These are large, slow speed (277 rpm) machines, and consequently the mechanical equipment room is 1½ stories high to accommodate the chillers and condensers. The units supply chilled water at 45 F, and operate at about 1.14 Bhp per ton.

Air Distribution Is Through Ceiling

All office areas other than those on the sixth floor are supplied with conditioned air via a perforated ceiling plenum distribution system, zoned by exposure and by interior working areas. One architectural feature of the building which particularly accommodated such a plan is the absence of interior columns on these five floors. Each floor is carried by deep beams spanning approximately 55 ft from the service core to the outside wall. Thus, an open expanse of 240 ft × 55 ft is created on each level.

TABLE 1 — GENERAL COMPARISON of rising costs and decreasing space allotments for air conditioning equipment can be gained from this listing of figures for original building and new addition

Item	Original building	New addition
Dimensions, ft	240 × 93	56 × 170
Gross floor area, sq ft	221,770	101,470
Total cost	$2,800,000	$2,859,500
Cost per sq ft	$12.60	$28.25
Cooling capacity, tons	650	300-900*
Leaving water temp, F, and temp rise, F	45 & 7	42 & 10
Compressor Bhp per ton	1.14	0.98
Refrigerating equipment space, sq ft	1650	1260-1800*
Air handling capacity, cfm	275,000 or 1.60 per sq ft	102,000 or 1.35 per sq ft
Supply air fan Bhp	1.45	51
Air handling equipment space, sq ft	8250	2650
Total refrigerating/air handling space allotted		
area, sq ft	9900	3910
volume, cu ft	147,360	56,480
area per ton, sq ft	15.23	13.03
volume per ton, cu ft	226.70	188.26
Space savings per ton — area	15 percent	
volume	17 percent	
Air Conditioning Cost		
Summer total	$309,800	$326,800
Summer per ton	$475.00**	$1090.00
Winter	$96,000†	$99,550

*Proposed, on basis of expected addition of 600 ton capacity unit for future expansion
**Includes cost allotment for neutral wall piping system
†Includes boiler plant which was large enough to supply new wing, so that no additional boiler cost is included in figure for new addition

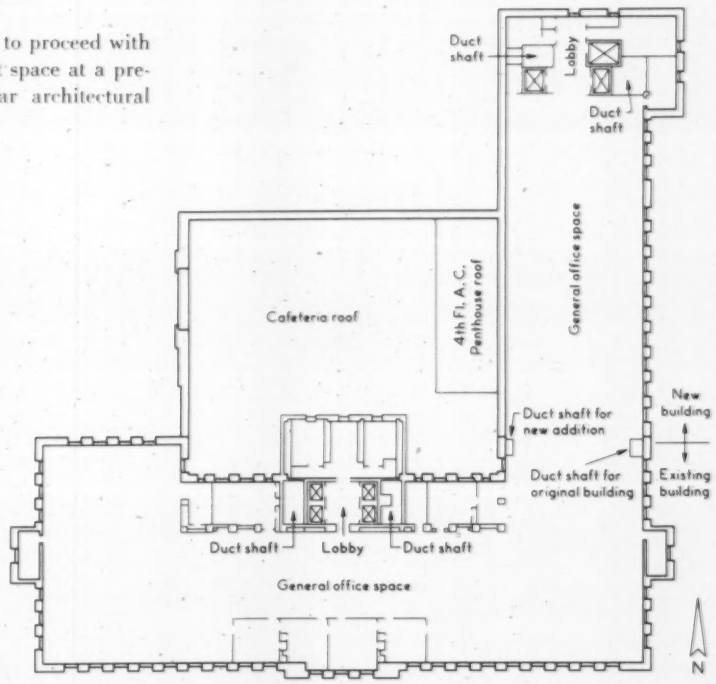
This building was planned originally as an air conditioned structure, and the cooling tower for the system is integrated in the building design.

Between the fifth and sixth floors, the 8 ft pipe space is used as a central return air plenum, as duct space for the distribution system on the sixth floor, and for pipe header space for the neutral-wall.

List Requirements for Addition

By the time the owners were ready to proceed with the new wing, costs placed equipment space at a premium. Besides the desire for similar architectural styling, other requirements were presented. All light fixtures were to be placed above the visible ceiling, and concealed overhead air distribution was requested.

The neutral-wall heating and cooling plan for exterior walls was to be retained, and the same type of zoning for heating and air conditioning would be used. Floor to ceiling heights were to match those of



2 PLAN VIEW shows how new wing was extended from original building. Cafeteria floor was built above existing auditorium

Architects: Tinsley, Higgins, Lighter and Lyon
Consulting Mechanical Engineer: (Original bldg.) Charles S. Leopold (Addition) Daniel B. Stevenson, Jr.

the original structure.

The addition, like the original, has no interior columns except within a service core at the far end of the wing and on the ground floor. Besides the wing itself, a 12,500 sq ft cafeteria was built above the existing auditorium.

Analyze Existing Facilities

The preliminary phase of the mechanical design involved a detailed analysis of the existing building facilities, including the boiler plant and central refrigerating plant, to see if any changes should be made in these.

After careful review of operating and maintenance costs for the 20 yr old system, it was our professional judgment that the refrigerating equipment could be expected to perform saisfactorily for at least another 10 yrs. without undue maintenance expense. Thus we deferred an approximate expenditure of $70 thousand for replacement. Besides, analysis of actual loads showed that the plant had sufficient capacity to pick up the 70-odd tons of cooling needed for the new cafeteria.

The existing boiler plant would also serve the needs of the new wing, and only a new steam boiler for the cafeteria kitchen equipment was needed.

Air conditioning equipment in the old building was doing an excellent job. Readings were taken at seven different locations on each floor, and produced a maximum temperature variation throughout the building of 2 F DB. Average temperature was about 76 F DB, and 62 F WB. Relative humidity was 45 percent.

Inside design conditions for the addition are 75 F DB, with a relative humidity of 50 percent, when the outside temperature is 95 F DB and 78 F WB.

Consider Layout of New Wing

Besides the cafeteria which is founded on the old building, the addition is of seven floors, all air conditioned, plus a non-air conditioned basement for mechanical and electrical equipment and other facilities.

Atop the seventh floor, a penthouse accommodates elevator equipment, exhaust fans, and the main central station air conditioning equipment.

Another penthouse tops the fourth floor roof of the cafeteria, and this one was a challenge.

The fourth floor houses mostly data processing equipment, and operates 24 hrs a day. Therefore a separate air handling system of 21,600 cfm capacity was designed to handle this area. Another similar system of 16,600 cfm capacity serves the cafeteria. Equipment for both is installed in the lower penthouse.

The structure subtending the cafeteria, which was the original building, was such that the penthouse could not exceed 20 ft in width without necessitating expensive cantilever support beams. Penthouse length was limited to 68 ft, and the height to one full story. Into this space went the air conditioning equipment just mentioned, plus accommodation for 10 zone pre- and reheat coils. Each system uses a combination return-exhaust fan, electrostatic filters, sprayed coil dehumidifier, supply air fan, outside air preheat coils, plus a 100 percent capacity outside air intake and 100 percent exhaust or return air capacity.

To compound the difficulty, part of the penthouse was over executive dining rooms, and the entire east side of the structure joined the west wall of the new addition. Needless to say, fan noise attentuation and generating duct noise were a major consideration, and acoustic liner was used liberally in supply ducts and return plenums.

"Pack" for Maximum Space Saving

The penthouse space problem was overcome as follows: Return air from the cafeteria was connected directly through the bottom of the air conditioning equipment, while return air from the fourth floor was routed through a 2 ft × 8 ft high plenum along the east wall, thence to the equipment housing. Discharge from the recirculating fans is vertical to an exhaust duct and damper system relieving through louvers at the ends of the penthouse, or through a short return air duct over the top of the casing to the mixed air duct.

Mixed air is relieved to the intake plenum upstream of the electrostatic filters, thence to the SWSI supply fans in the middle of the enclosure. Supply air is fed to an acoustically lined plenum out of which the respective zones are tapped, with zone reheat coils staggered for access and service. The zone ducts are, of necessity, three deep in some places.

One System Supplies Remainder

All of the other floors of the new wing are served by a 63,850 cfm capacity central station unit located in the seventh floor penthouse. Equipment arrangement here is generally similar to that in the enclosure just described, except that a DWDI supply air fan is used.

Supply air is delivered to a vertical shaft duct header from which two zone ducts are tapped at each level. Each zone duct contains a reheater coil. Of the two, one duct serves the east exterior zone and the other the interior. No west zone is needed since a corridor runs the length of the windowless west wall on each floor.

The two header ducts are located above the furred

ceiling along the west wall. Branch take-offs from the tops of the headers are held two layers deep tight against the underside of the floor slab above, extending to the individual zones within the major east-exterior and interior areas.

Once in the zone, the ducts are tapped for supply grilles at intervals of 5 ft on center to distribute air to the ceiling plenum.

An "egg crate" ceiling accommodates both lighting fixtures and air distribution. The face velocity through the false ceiling is 6 fpm, a figure proved workable in a private industrial laboratory prior to design approval. Supply grilles are sized so as to create a condition of free-falling air as much as possible, thus avoiding objectionable down drafts.

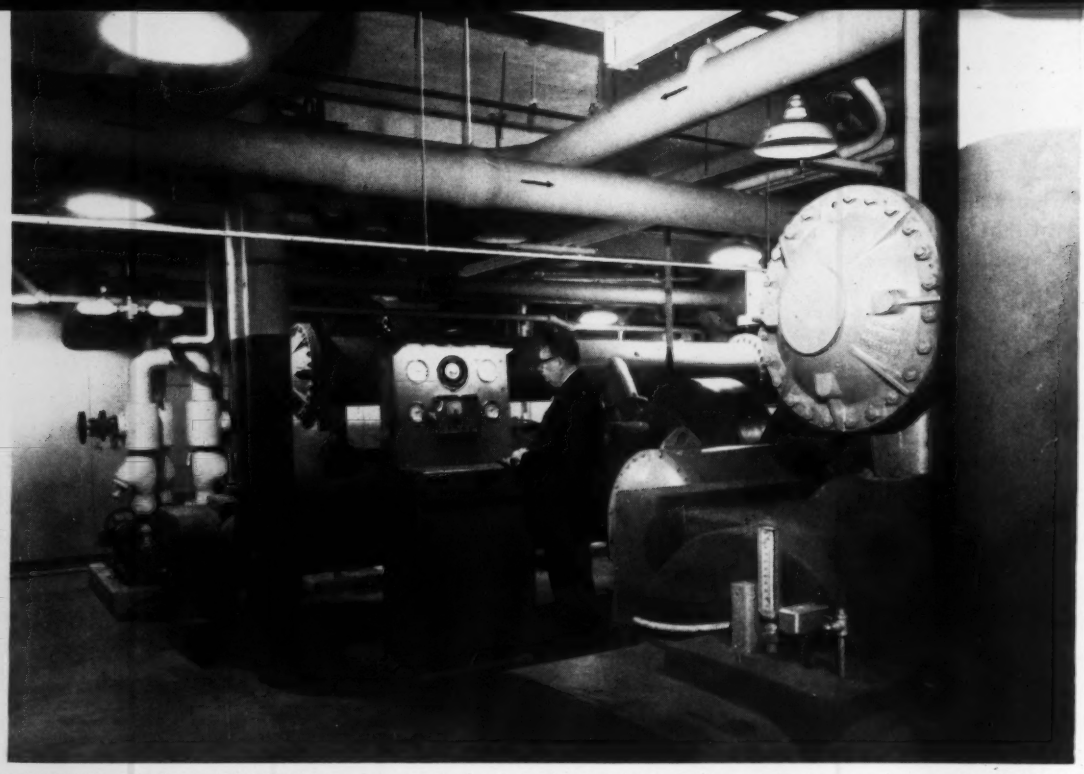
Since each general office floor is basically a large open expanse, return air is taken along the entire north, or service core end of the wing, and in addition through intakes to a return air duct shaft in the southwest corner. The latter relieves air to the fifth floor pipe space, through which it travels to the main return shaft at the north end.

Thus, supply air is delivered down the east shaft of the service core, and returns up the west shaft, all within the relatively small area at the one end of the wing. The equipment penthouse is located directly above the service core.

Sixth floor air conditioning in the new wing operates exactly as does the system on the same level in the original building.

EGG-CRATE ceilings accommodate lighting fixtures, allow supply air at face velocity of 6 fpm to enter rooms. Supply diffusers are sized to create condition of free falling air

NEUTRAL WALL system is used in both old and new sections. Pipes are supplied with either hot or chilled water during periods of heat loss or gain



BUILDING SUPERINTENDENT Roy Stinson checks control panel for one of two 150 ton capacity centrifugal chillers installed for new wing

Two 150 ton capacity centrifugal compressors are located in a basement room. Provision is made for an extension of this room to accommodate an additional 600 ton compressor for future expansion of the new wing to the west. The present chilled water piping header is designed to handle this additional load. These machines also supply chilled water at 42 F.

Therefore, the mechanical equipment room is basically a future design where three refrigerating machines and accessories, with a total capacity of 900 tons, will be located in a room of 1800 sq ft, and 21,620 cu ft.

This is 2.0 sq ft and 24 cu ft per ton, as compared with 2.5 sq ft and 56.5 cu ft per ton for the existing building.

The cooling tower for this new system is located on the roof of the addition (Fig. ?). Controls are arranged so that any piece of equipment may be started from a main control panel in the mechanical equipment room, or at the equipment itself. An extensive temperature indicating system used in the original structure is also employed for the new wing. The building superintendent can read the temperature in any zone, in the neutral-wall furred space, and entering and leaving temperatures at the central station equipment.

Note Space, Cost Comparisons

As mentioned earlier, Table 1 presents a comparative view of the old and new buildings and air conditioning systems relative to cost and space needs.

Such a side-by-side comparison enables one to fully appreciate the effect of changing times on the demands placed upon air conditioning design personnel. Since the design of the new system meets the requirements of the owners relative to cost and space, Table 1 is really a proof of the contention that as building costs and equipment expense continue to rise, the demands on the mechanical engineer are proportionately for less space and more economy.

Both area and volume requirements should be considered. In this instance, the required area per ton capacity was reduced by almost 15 percent; the required volume by about 17 percent.

These figures are particularly significant because the new system has less than half the capacity of the original. Equipment size and space needed for access, however, do not rise or fall in direct proportion to a rise or fall in capacity, but more nearly on a ratio of the square of the increase or decrease.

Therefore, for two identical installations, an 800 ton capacity system would require only about twice the area of a 200 ton system.

If the present increasing cost trend continues, as it is likely to do, engineers concerned with the design of big building heating and air conditioning systems will have to apply ever more careful analysis to their work, or budgets will never be met.

The air conditioning contractor for the Bankers Life Co. building was Iowa Sheet Metal Contractors, Inc. Heating contractor was Harris Plumbing & Heating Co. ⧺

MTHW Heating Reduces Costs, Requires Precise Engineering

VARIOUS aspects of designing medium temperature hot water (MTHW)[1] heating systems were presented at the recent meeting of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers held in Chicago, Ill.

Primary-Secondary Pumping

Homer M. Bird, consulting engineer, Bird, Bird & Associates, stated that his firm had striven for several years to find an economical means of transporting and utilizing the high quantities of energy carried by water. This energy has been available, he said, but heat transfer equipment and systems have failed to recognize it. His firm has found that MTHW satisfies their obective of economy since deep temperature drops can be used. This results in smaller pipe, pump, and motor sizes than those for LTHW[1] systems but permits use of standard equipment and Schedule 40 pipe.

A deep temperature drop with LTHW terminal units emphasizes some of the problems associated with conventional LTHW design, which Mr. Bird listed as:

1) Control problems when two-way valves are used due to the changing pressure drops as the loads in various parts of the system vary.

2) Bypassing in the terminal unit, added expense, poor purging, and freeze hazard when using three-way valves, which reduce pressure fluctuations and provide better control.

In addition, the low water velocities associated with MTHW or deep temperature drop without secondary pumping causes quick fouling of conventional radiation. However, Mr. Bird noted that terminal units designed for large temperature drops tend to limit these problems.

The piping arrangement selected by Mr. Bird's firm is a primary-secondary pumping system. This piping arrangement consists of four interrelated circuits as follows:

1) Source heat circuit — source heat pump maintains circulation in the source heat circuit and delivers MTHW supply water from the boiler to mixing pumps at each bypass connection.

2) Mixing circuit — mixing pumps draw water from the supply main and deliver it to a mixing tank where source water and return water from the primary circuit are mixed. Flow of source water to the mixing tank is controlled to provide a mixed water temperature which varies with outdoor temperature. The mixing tank has no internals and is often made from short sections of Schedule 40 pipe.

3) Primary circuit — primary pumps circulate the mixed water through the primary mains to the various zones bypasses.

4) Zone circuit — the zone air temperature is controlled by means of an ambient thermostat and a zone pump circulating water from the bypass through the

[1]*Medium temperature hot water (MTHW) systems are usually defined as those with supply water temperatures from 250 to 325 F. Low temperature hot water (LTHW) systems are usually defined as those employing supply water temperatures below 250 F.*

TABLE 1 — COMPARISON of five systems shows estimated savings with MTHW and primary-secondary pumping for system capacity of 1,280 MBtu per hr

System	Kind	Temp. diff., F	Supply temp., F	Primary main size, in.	Flow rate, gpm	Pump horsepower		Savings 40 yr life
						installed	running	
1	LTHW	20	220	3½	128	5.35	3.33	.....
2	LTHW	65	245	3	58	1.85	1.85	$21,000
3	LTHW	130	247	2	16.3	1.95	.84	52,000
4	MTHW	150	275	1½	14.1	1.95	.84	51,500
5	MTHW	203	325	1½	10.5	1.43	.58	56,400

zone circuit to the terminal units. Thus, temperature control is accomplished without using modulating valves, thereby eliminating the problems associated with control. When modulating valves must be used, they can be selected for a constant pressure drop below that normally needed in primary pumping systems.

Mr. Bird's firm has used the primary-secondary pumping system in nearly all types of buildings, including a number of schools. One such design utilizes 275 F supply water with a 130 F temperature difference. The zone pumps operate about ⅓ of the time in this installation.

A comparison of five system arrangements employing various supply temperatures and temperature differences for a system of 1,280 MBtu per hr was presented by Mr. Bird. Some of the more important variables given in the comparison by Mr. Bird are listed in Table 1.

Mr. Bird noted that more equipment designed for low water flow rates, and high temperature differences is needed. At present, he said, the 325 F primary-secondary system with a 203 F temperature difference as outlined is not possible unless ¼ hp and larger source heat pumps are required.

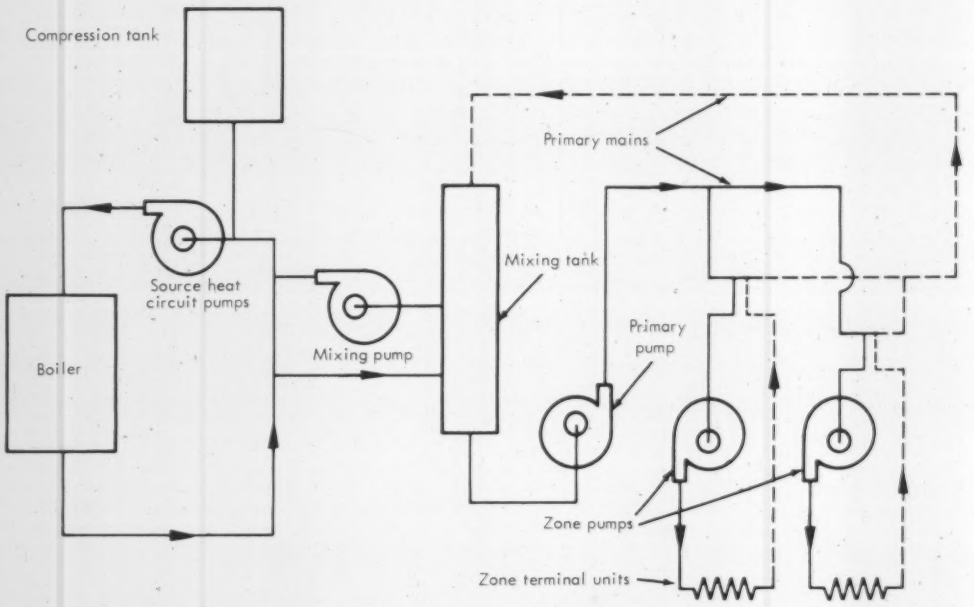
It is interesting to note that the copper in the source heat circuit piping — assuming copper piping — totals 537,000 circular mils in a 203 F hot water circuit. For electric heating of the same capacity in the same system, the conductors would total 2,400,000 circular mils of copper.

Selecting Terminal Units

The larger the temperature difference used in MTHW terminal units the more economical the system will be, S. W. Miller, Jr., chief development engineer, J. J. Nesbitt, Inc. stated. The cost of a system decreases with an increase in temperature drop at the terminal units, but with diminishing returns at higher temperature differences.

The small water quantities associated with high temperatures drops improve control, he said. On the other hand, high supply temperatures increase the cost of the components and may adversely effect control. Thus, it is desirable to design for the highest possible temperature difference but the lowest supply temperature.

The MTHW system must be carefully designed, Mr. Miller cautioned. "Safety factors" can result in high flow rates and low actual temperature differences and poor performance of the terminal units. To avoid such problems, careful pipe and pump sizing is required. The temperature differences that can be achieved by various terminal units and the tem-



PIPING arrangement of type described by H. M. Bird for a MTHW system with primary-secondary pumping is shown in simplified schematic form here

perature differences in common use were given by Mr. Miller as follows:

Supply temp., F	Possible temperature differences, F				Temp. diff. in common use, F
	Conventional radiation	Unit heaters	Fan Coil Units		
			Heating	Ventilating	
180	20	30	40-80	60-100	20
240	30	40-80	80-120	100-150	20-80
320	40	60-120	120-160	140-180	80-100
400	40	150-200	140-220	200-240	150-200

Mr. Miller noted that heat exchangers for small water quantities may cost no more than conventional radiation. This is because the conventional element can be recircuited in many cases for use with higher temperature drops. Heat transfer in water-to-air heat exchangers is expressed by the following formula:

$$H = U A T_m$$

where

H = heat transfer, Btu per hr
U = overall coefficient of heat transmission, Btu per hr sq ft per deg F
A = area of heat transfer surface, sq ft
T_m = mean temperature difference, F

When a heat exchanger is recircuited, the water velocity is increased which causes a corresponding increase in the overall coefficient of heat transmission "*U*". The area remains the same. Thus, the increased heat transfer due to recircuiting may partially offset the reduction in mean temperature difference and the cost will not increase.

The most economical MTHW design according to Mr. Miller will result from:

1) Using the highest supply temperature in the class for which the equipment is designed.

2) Selection of each terminal unit for the smallest possible water quantity which will provide the required amount of heat.

3) Careful design of the piping system using precise data and a minimum safety factor.

Mr. Miller cautioned against the use of overall temperature difference in design. This is because the actual temperature drop almost always differs from the design value. Temperature drop should be considered a tool but the use of an overall temperature difference handicaps economical design, he said. The most economical system will result when the designer employs the maximum temperature difference at each terminal unit. From this, the system flow rate can be established and the piping system should then be designed on flow. In any case, it is desirable to design for the smallest possible flow rate satisfying the heating loads.

In summary, Mr. Miller noted that small water quantities reduce cost and improve performance but require precise engineering. Small water quantities result from an increase in supply temperature, higher terminal unit temperature drops, primary-secondary pumping, and more efficient terminal units, he explained.

Pumps for MTHW Systems

To insure good life of the pumps in MTHW systems, G. F. Carlson, chief engineer, specialty division, Bell & Gossett Co., listed the following points that must be observed:

1) Provide a pressure tank (usually gas pressurized) at the pump suction to prevent cavitation and flashing in the system by adequate pressurization.

2) Provide an air separator at the pump suction.

3) Operate with clean strainers.

4) Provide proper NSPH (net positive suction head) at the pump to prevent cavitation.

5) Good piping design with proper hanging and flexibility to prevent stress on the pump housing.

6) System should be cleaned and flushed prior to start-up. A solution of tri-sodium phosphate is satisfactory for cleaning the system.

The pump may be located either in the return or supply piping. When located in the return, the pressurization tank is designed to "float" on the return line just upstream of the pump. When installing the pump on the supply side it should be remembered that the pump will always be operating in the hottest water. Mechanical seal pumps, which are preferred for MTHW service to keep leakage to a minimum, with ordinary seals will operate satisfactorily in water up to 225 F (continuous) and in water up to 250 F (modulated). With special seals they can operate in water up to 300 F. Water cooled gland type pumps are available for operation at temperatures of 300 F and over.

The need for precise engineering in sizing pipes and pumps if the system is to perform as anticipated was emphasized by Mr. Carlson. Comparing pump selection based on a number of different pressure drop charts now in use for water, many of which have built in "safety factors" for varying degrees of surface fouling, he illustrated how one arrives at a "false" specified operating point. This results in flow rates and power greatly in excess of that required. When safety factors are added, the errors are increased and the flow and power increase still more. In a closed, sealed, and tight system, one which is designed so that no air can leak into the system and a minimum of water loss occurs, the piping does not corrode and, no correction for aging is needed, he said. In fact, some HTHW designers have suggested that the pressure drop decreases with time under these conditions though this must yet be confirmed.

Mr. Carlson recommended development and Society approval of a single pressure drop chart for all water temperatures. He illustrated how such a chart can be developed. The use of a single chart with no correction for aging would eliminate present confusion, he said, and eliminate excessive horsepower wastage.

MTHW Reduces Costs

The MTHW system is as simple in arrangement as LTHW systems and in many respects the same as conventional systems except that the MTHW system must be mechanically pressurized explained R. M. Harmon, Jr., president, Harmon and Beckett, Inc., consulting engineers. MTHW has now been used in 100 jobs by his firm in a full range of buildings. When LTHW and MTHW have been bid competitively in the same building the MTHW systems range from 18 to 22 percent lower in first cost than the LTHW systems. They have found in their designs that supply water temperatures in the range from 280 F to 320 F produce the most economical design. The highest possible temperature difference for a given system is used. Secondary heating devices are designed to provide a 20 F temperature difference between the leaving MTHW and the highest secondary temperature.

They have had some difficulty in convincing the client and building officials that MTHW can be operated without the services of a full time operating engineer, Mr. Harmon said. To illustrate the safety of the system, he has placed his hand in the discharge of a ¾ in. valve on a steam pressurized boiler operating with a supply temperature of 310 F. To emphasize the difference between steam and MTHW systems with respect to safety, Mr. Harmon compared the heat content of steam and water at 325 F and 81 psig. The heat content of saturated liquid is only 295 Btu per lb while that of the saturated steam is 1186 Btu per lb or four times as much. When the water is suddenly released from the MTHW system, only the difference between the heat content at saturation and that at 212 F (180 Btu per lb) or about 115 Btu per lb is released. This breaks the water into a fog which cools rapidly from 212 F to room temperature due to entrainment of cool air, evaporative cooling, and recombination of fog into larger particles. He suggested that no attempt be made to explain the process to the client.

Mr. Harmon stated that he preferred to use water tube boilers in MTHW systems, though others may be satisfactory. Bent tube, water tube boilers are preferred because orificing is easily accomplished when needed to assure equal flow through the tubes. When questioned about the need for strainers to prevent clogging of the tube orifices, he explained that orificing of the tubes is not used in small systems (up to 1000 MBtu per hr). Instead, baffling is used to obtain uniform heat transfer rates. In larger boilers, orifices are large enough so that sludge in the system does not plug them up. Thus, no problems have been experienced.

To assure satisfactory boiler operation the following features should be specified according to Mr. Harmon:

1) Boilers should be designed for controlled circulation.

2) Maximum pressure drop through the boiler should be 10 psig.

3) No steaming space should be included in the boiler.

4) The manufacturer should certify that the boiler is suitable for MTHW service.

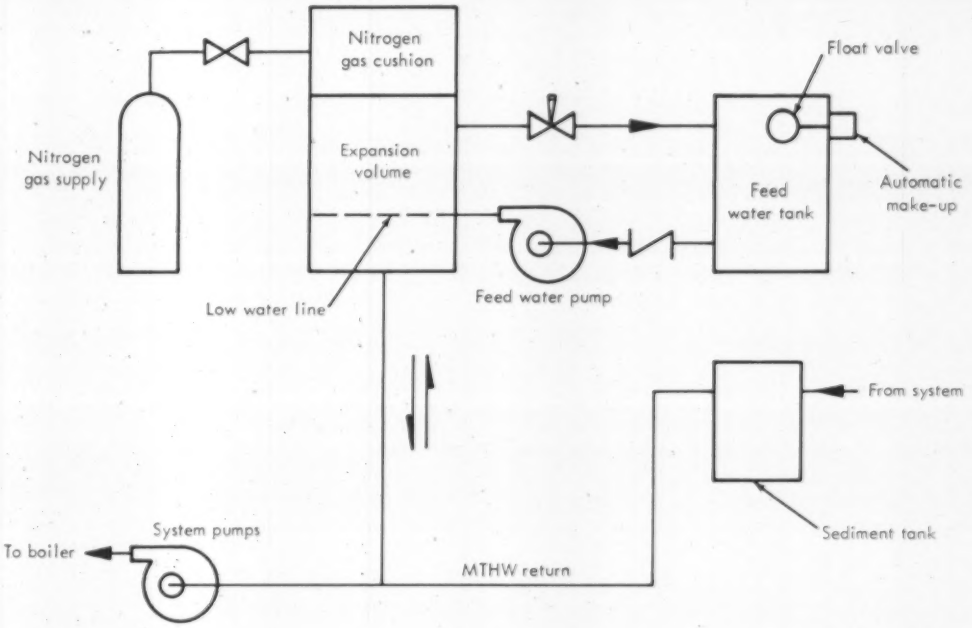
5) Tubes in the primary heat transfer zone should be designed for upflow and nonimpingement of the flame on the tubes. His experience suggests that maximum heat transfer rates for the tubes in gas and oil fired boilers should not exceed 125 MBtu per hr per sq ft of heating surface. For coal fired boilers the maximum rates should not exceed 95 to 105 MBtu per hr per sq ft depending upon the ash fusion temperature.

Tests of several gas-fired MTHW installations have indicated boiler efficiencies ranging from 80.6 percent at ¼ load to 81.8 percent at full load. The flat performance curve demonstrates, Mr. Harmon said, the practicability of MTHW design. In an actual system the load can vary from 100 percent down to 10 percent of the installed capacity. As an example Mr. Harmon listed the operating capacities for one job with a total load of 1000 MBtu per hr in which two 500 MBtu per boilers were installed. The measured loads during the various seasons were as follows:

Season	Months	Boilers Operating	Load in percent of capacity
Winter	Nov.-Mar. (5)	2 - 500 MBH	80
Spring	April-May (2)	1 - 500 MBH	50
Summer	June-Aug (3)	1 - 500 MBH	20
Fall	Sept-Oct (2)	1 - 500 MBH	40

Standard Schedule 40 pipe is used throughout their piping systems Mr. Harmon said. Joints are welded and they use socket and butt weld fittings and weldolets. When flanges are used, a 150 lb pattern flange is selected. Small diameter piping is bent. The use of flanged joints is avoided except at pumps in the interest of having a closed, tight, and sealed system to minimize makeup water requirements. Cast steel butt weld valves are used. Bronze trim is considered unsatisfactory. Gate valves are used where positive shutoff is required.

On small MTHW systems where automatic feed



GAS PRESSURIZATION system for MTHW shown above is similar to that used by R. M. Harmon. Similar arrangements are used to pressurize HTHW systems

is not considered economical, a low water cutoff and manual makeup is used. Since leaks are not easily detected, this prevents the addition of excess makeup water which can add to sludging and increase corrosion in the system. When water is required, as indicated by boiler shutdown, the operator knows he should check for leaks. Red easter egg dye tablets in the system can serve very nicely to help locate leaks, Mr. Harmon said.

The pump location depends upon the method of pressurization. In steam pressurized systems, the pumps are located immediately downstream from the expansion drum. In gas pressurized systems, the pump is located in the return. Location of the pump in the coolest water is preferred. This places the pump in the return and the system should be pressurized just upstream of the pump. When the pumps are located in the supply water, a jacketed water-cooled pump may be necessary.

Of the several potential methods of pressurizing the MTHW systems, steam and gas pressurization have been used. Early systems employed steam pressurization but his firm now uses gas pressurization exclusively, Mr. Harmon said. The gas pressurized system employs a compression tank with the cushion space charged with a fixed quantity of nitrogen gas. No system water circulates through the tank and the piping between the tank and the return main is sized to prevent convection. Thus, the tank is relatively cool and does not require insulation. The compression tank can sit on the floor and requires no internals. The size of the compression tank in a gas pressurized system is less than ½ that required for steam pressurized systems.

Mr. Harmon uses a packaged gas pressurization system which includes the compression tank, a feed water tank, and the necessary controls. No special equipment is required for gas pressurized systems.

During operation, as the system water expands and pressure increases in the compression tank, a pressure operated valve opens and allows excess water to flow to the feedwater tank. When the water level in the compression tank drops to a predetermined level during decreasing loads, a feedwater pump transfers conditioned water back into the compression tank. They have found that pressurizing to 15 psi above the saturation pressure is adequate except in large systems and those in which changes in elevation may require greater overpressure.

In closing Mr. Harmon cautioned against the use of complex control systems. The same controls that are used for LTHW can be used for MTHW, he said, except for those related to the pressurization system. ≠

NORTH FACADE of tallest building in Albuquerque, N.M., presents large glass exposure to intense southwestern sun. All major air conditioning equipment is located behind sign on top level. First bay at left is open, second and third house central fan room, fourth the boiler room, and fifth cooling tower. Overhead supply air diffusers and lighting fixtures are visible through windows

Dual duct system tames southwestern sun and changing temperature

Engineers Raise the Roof To Heat, Cool Albuquerque Bank

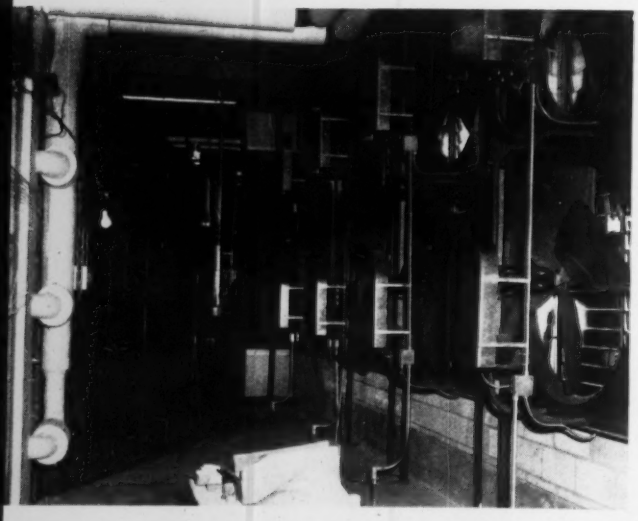
● The extreme daily temperature variation in southwestern United States calls for big building air conditioning which offers the utmost in flexibility. In Albuquerque, solar radiation is intense, due to a 5000 ft elevation and unusually clear skies. Year 'round air conditioning in a modern glass-facade building poses a challenge of some dimensions in such a climate. For the new Bank of New Mexico building, a high velocity dual duct system with all major mechanical equipment installed on the roof beats the climate problem and saves premium office space at the same time.

By ROGER W. HAINES
Bridgers & Paxton
Consulting Engineers, Inc.

CLIMATE CONDITIONS in some parts of southwestern United States impose a kind of textbook set of circumstances for the design of large building air conditioning. Many climate factors are exaggerated. To satisfy comfort requirements, a year 'round system has to be extremely flexible.

For instance, in Albuquerque N. M., where the elevation is near 5000 ft, the exceptionally clear atmosphere serves to increase solar radiation intensity some 10 to 15 percent over cities in industrial areas at sea level.

Albuquerque has a daily temperature variation of as much as 40 F during all but the summer months.



FAN ROOM on 15th floor shows fan plenum with heating-cooling coil connections at left, relief fans at right. Return air damper and motor are at left center. Relief fans operate in sequence as outside air dampers open and close

SUPPLY-RETURN AIR CHASE extends down south side of building. View shows top of chase with warm air duct at left, cold air duct to right. Uninsulated duct is toilet exhaust. "Waste" space in chase serves as return air duct from each level, exhausts directly to fan room

which means that at the very least, both heating and cooling will normally be required before working hours are over.

Devise Unique Plan for Bank, Tenants

The architectural character of the new Bank of New Mexico building in this city required an air conditioning plan that would handle the climate problems even when intensified by building design.

The bank consists of a large ground floor area topped by a 13 story tower. Actually the building facade is 15 stories high, with the top level given over to mechanical equipment space.

Ground floor and basement areas are occupied by the owner-bank and by a brokerage firm. The fourteenth floor houses a private club, normally open during the evening hours. Two sides of the structure front on public streets, and a driveway for drive-in bank traffic takes up the remaining two sides.

This was one of the first considerations — outside air access for basement-located air conditioning equipment was not to be had.

North and south exposures of the building presented large areas of glass, and because of the intense solar radiation noted earlier, it was anticipated that areas on the south side would require cooling even when the outside temperature was 25 F. Besides, the west side of the first floor is of continuous glass face 16 ft high. Finally, occupancy heat gain would be such that a large interior zone would require cooling all the time.

Because of the "unusual" hours maintained in the fourteenth floor club, that area had to be treated with special consideration.

Choose Dual Duct System for Flexibility

A dual-duct high velocity air distribution system was selected to provide the required zoning between the north and south exposures. By means of large, zone-oriented mixing boxes, the need for concurrent heating and cooling was filled.

At the time of the design stages, only the first and top floor rentals had been settled. Between these, the only known fact was that the various floors would

TYPICAL DISTRIBUTION system for one level is shown here, before installation of ceiling. Supply-return chase is at left rear. Ducts lead to mixing boxes which provide five zones per floor through ceiling supply diffusers

COOLING TOWER is installed in "cubbyhole" on roof, immediately adjacent to bay which houses steam absorption refrigerating machine. Concrete beam between cells supports outer curtain wall

be used generally as office space. Therefore, some sort of modular arrangement was required, so that inside partitions could later be adjusted to suit the as yet unknown tenants.

The dual-duct system allowed this flexibility. Ceiling air diffusers and side wall return openings are spaced on 4 ft centers, with each floor divided into a total of five air distribution zones. The five mixing boxes per level allow a rapid changeover from heating to cooling or combination in a relatively small individual space. Partitions can be installed at any window mullion, allowing variable office sizing of 8 to 24 ft widths in 4 ft increments.

Major Equipment Is Roof-Mounted

The extension of the building facade to the 15 story level provided adequate space for the installation of all major heating and cooling components. This eliminates the problem of air access to the basement. Large condensing water lines which would have taken up rentable space on all 14 floors are also eliminated.

The central fan system with cooling-heating coils in the same roof-top location centralizes any necessary maintenance and does away with business interruption for maintenance on the occupied floors.

Use Steam Absorption Chiller

We took advantage of the economical natural gas available in this part of the country to fire the 340 ton capacity steam absorption water chiller. A gas fired boiler provides steam for heating. The boiler and refrigerating machine space is adjoined by the central fan room on the one side, and by the cooling tower bay on the other. The economies of such a shortline installation are apparent.

To satisfy the odd-hour demands for the fourteenth floor club, a separate multi-zone air handling unit is installed for that area, so that the large main air system need not be used when only the club is occupied.

One Chase Handles Supply, Return

Air distribution from the roof fan room is via a large chase on the south side of the tower. Supply ducts are tapped off the main supply header at each level, from which the five zone mixing boxes distribute the tempered air to the various areas. Additional zones are provided on the first floor and in the basement. A pneumatic control system with space thermostats controlling the high velocity mixing boxes accomplishes area temperature control. Each mixing unit has a constant volume controller. 100 percent outside air is admitted to the fan system for cooling when the outdoor temperature is 55 F or less. Above this temperature point, the absorption machine is activated automatically.

All air supply to the rooms is by ceiling diffusers, except that supplemental sill supply openings are provided beneath the high windows on the west side of the first floor.

Return air grilles are located beneath the windows on outside walls, and are arranged on the same modular basis as are the supply diffusers. For interior zones, return air openings are placed in the ceiling with the supply outlets.

Return air is conveyed to the same duct chase which houses the supply duct, thence directly to the fan room, which acts as a plenum. Temperature controlled return air-outside air mixing dampers are provided, and relief fans for this large plenum start and stop in sequence as outside air dampers open and close. ⧺

Tests produce piping design recommendations —

How Temperature, Velocity of Potable Water Affect Corrosion of Copper and Its Alloys

By MALVERN F. OBRECHT, PhD
Water Treatment Consultant
and Professor of Chemical Engineering
and
LAURENCE L. QUILL, PhD
Head, Department of Chemistry
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A REVIEW of the problems of corrosion of copper and copper alloys in cold and hot water distribution systems indicates that the limiting factors which affect the corrosion process are frequently not recognized nor are they considered in the design of a particular system.

Engineers, architects, and building designers should design potable water distribution systems to meet these factors. The major variables are water velocity, water temperature, water quality, and the service demands on the system.

Earlier articles outlined the erosion-corrosion problem which may arise with use of copper and copper alloys in potable water systems, and discussed methods of studying and solving the problem, based on extensive experimentation at Michigan State University. A resume of the experimental means and procedures is presented in another section of this article.

The earlier reports were concerned with the effects of water quality, velocity, temperature, and alloy composition on the erosion-corrosion process. Now we can proceed to summarize the results of the investigations, to make suggestions for better engineering practice, and to list unfinished and unanswered questions about the problem.

Copper and Red Brass

One of the most important factors influencing the corrosion of copper and red brass is service temperature. At any given temperature, the actual rate of corrosion is dependent on the velocity of the water, water quality, and the continuous usage period.

Continuous usage or recirculation of service water results in higher corrosion rates than will be experi-

• Extensive tests on the erosive-corrosive effects of potable water in copper and copper alloy distribution systems have been conducted at Michigan State University. Test findings are related particularly to the influence of temperature and velocity factors, chemical action, and the character of the corrosion that takes place. The three parts of this article include a digest of the test results, a resume of the test methods and procedures, and a summary of what the data that is now available should mean to the engineer who designs this kind of piping system. Six previous articles in this series (References 1 through 6) have reported the specific results of the various parts of the tests.

enced with intermittent service, even though actual flow times are equal. A period of rest in flow appears to be beneficial in reducing erosion-corrosion in potable water distribution systems.

Water containing oxygen in excess of 2 ppm and carbon dioxide in excess of 10 ppm, and which is softened to "zero hardness" imposes an upper limit of 140 F for maximum continuous service temperature and 4 fps as a maximum velocity, if erosion-corrosion is to be prevented.

These limits can be eased by a) blending of hard water to give a positive Langelier Index, b) neutralizing the carbon dioxide content of the water to a maximum of 5 ppm, or c) by removing or substantially reducing the oxygen and carbon dioxide content of the water by cold deaeration, or d) by scheduled intermittent operation of the water distribution systems in service, to allow for periods of film formation.

Other Tests Confirm Data

It is important to note that similar tests in other communities on domestic residential hot and cold water services showed no erosion-corrosion after four years of service. These well waters contained oxygen and carbon dioxide and were zero softened by a sodium zeolite unit. Samples of copper tubing removed from bends leading from hot water heaters showed no evidence of erosion-corrosion. These systems had the average domestic use, with the usual long periods of rest at night.

Hospitals Show Opposite Results

On the other hand, several cases of field failure of copper tubes due to erosion-corrosion have been encountered in hospitals using sodium zeolite softened well water, in other communities. The waters were hot and under forced circulation, and were used for laundry, bathing, dishes, etc.

The hospital cases were solved by enlarging the copper tube to decrease water velocity, and by operating the circulating pumps only during daytime hours, and by keeping temperatures below 140 F.

The inspection of numerous copper tube hot water closed systems with soft water and continuous circulation for heating showed no corrosion damage. Such heating systems have low water makeup and usually very long rest periods during the off-heating season. The closed systems rapidly use up available oxygen, and corrosion is usually arrested.

Oxygen Content Is Important

Thermodynamic calculations indicate that oxygen-free water will not corrode copper. This fact has been confirmed by static corrosion tests with oxygen-free water, as described in Reference 8. The concept was put to practical use in our own experiments with main test panel No. 5 (Reference 5) through which deaerated water was run.

Laboratory experiments with pure copper and pure water, to which was added controlled quantities of oxygen and ions as found in potable water, indicate several facts.

Corrosion Lessens as Film Builds Up

The initial corrosion rate for copper in high purity oxygen-containing water at 140 F amounted to about 5.6 mg per sq cm per day, or 90 mils per year as measured by the slope of the corrosion rate curve. This high rate dropped to a fraction of that value as the metal became coated with a film of corrosion products.

In the initial corrosion, the corrosion products contain predominantly cuprous oxide. Films of corrosion products formed on copper are effective in inhibiting corrosion.

High velocities and high temperatures may affect film stability, and in that event, corrosion will increase. The presence of chloride and/or sulfate ions tends to increase the corrosiveness of water and causes pitting. Bicarbonate and carbonate ions in the concentrations commonly found in natural water do not accelerate corrosion. Free carbon dioxide tends to increase the concentration of dissolved copper in both acidic and slightly alkaline waters, and to increase the rate of corrosion.

Studies Show Importance of Films

These experiments amplify again the significant role of corrosion product films in reducing long term corrosion and in controlling the overall reaction. Since pitting could destroy the effectiveness of surface films, a study of the extent of pitting activity on copper of dilute solutions containing oxygen, carbon dioxide, and the ions commonly found in potable waters might help to predict long range corrosion tendencies.

Also, very little is known of the effects of erosion on previously established protective films. It is natural to assume that if erosion-corrosion can result in perforations of copper tube, that a previously established film might not be able to withstand the action of the water indefinitely, no matter how heavy the film might be at the outset.

Film stability, and hence the protection afforded a metal surface, is dependent primarily on the conditions of formation and on the solubility of the film itself. In the case of carbonate films, the problem may be complicated by the fact that the solubilities

and stabilities of copper carbonate are apparently complex.

The problem of erosion-corrosion of inlet ends of copper and red brass heat exchanger tubes should also be considered. When water is passed through the tube side of the exchanger, excess turbulence often occurs at the inlets of the various passes, causing serious local corrosion.

This can be solved by limiting the flow velocity, or by the use of plastic inserts in the critical tube-end areas, or by designing distribution baffles, or by passing water through the shell side of the exchanger. If this last solution is undertaken, proper attention must be given to baffle design, in order to avoid short circuiting the flow or the creation of excess stress at contact points to baffle and tube surfaces. Reference 1 records the erosion-corrosion effect resulting from baffle leakage in hot water heat exchangers.[1]

Cautions on Velocity

Velocities in excess of 5 fps are to be avoided with water in the temperature range of 160 to 180 F in copper or red brass tube, with any quality of water, when the flow is continuous. Water temperatures of 200 F and velocities in excess of 5 fps are *less* corrosive with all water qualities than are temperatures in the 160-180 F range.

"References" and superior numbers throughout text refer to listing at end of article

Why and How Tests Were Conducted

Following World War II, a number of large university construction programs to provide new dormitories, classrooms, laboratories and other facilities included an extensive use of Type L deoxidized copper tube for water distribution systems. Copper was used for several reasons. Though it costs more than some other materials, it is expected to have long life; it is simpler, faster, and more economical to install, and as compared to galvanized iron, does not plug with deposits as rapidly.

Good Service Has Been Realized

Use of copper tubing in such systems has increased greatly during the past several years, and generally has proven to be most satisfactory. However, in a few instances, due to unusual local conditions, severe erosion-corrosion has occurred.

One instance of failure was at Michigan State University, in newer dormitory units and in public buildings such as Kellog Center and the Student Union. Here, leaks appeared earliest and in greater numbers in hot water lines, but were also evident in cold water lines, and were most prevalent in newly installed distribution systems in which zeolite softened water under forced circulation was carried from the start. Leaks in older systems were very uncommon.

Natural Coating Protects Pipe

The difference in the tendency towards corrosion and subsequent leakage, we discovered, was related to the presence or absence of coating on the inside of the tubes.

New tube, in which zeolite softened water was used from the outset, had no protective coating. Older, pre-WW II tube had a protective film of thin, hard, adherent carbonate silica deposit.

How Did It Happen?

Older dormitory systems had been operated for several years with very hard water taken directly from wells. Then, when water softeners were installed, they were at first regenerated on a very irregular schedule.

The combination of prolonged exposure to hard water plus the later not-too-thorough softening program appeared to have caused a more or less permanent protective film to become firmly established.

A planned operational procedure like this would not be practical in modern use. Today, softeners would be included in the initial installation, and soft water, kept soft by regular control, would be used from the start.

How Did New Tube Fail?

Examination of corroded sections of copper tube from the newly installed systems showed general pitting of the inner surfaces. Many pits had thin films of cuprous oxide along the bottom; others were entirely free of any deposit and had bright, shiny metal surfaces. Many of the pits were crescent shaped.

In profile, when tubing was cut lengthwise, extensive undercutting was revealed, and the undercut portion of the pit was always located downstream. This "directionality" of the undercutting angles and crescent-shaped pits correlated with the direction and flow rate of the water. Combined erosion-corrosion was indicated.

Was Corrosion Electrolytic?

The combination, in some specimens, of bright, shiny metal pit areas and coated, darker areas raised questions about electrolytic corrosion analogous to that which results from the contact of dissimilar metals, or to the corrosive effects on metals placed in moist soil where stray currents bring about electrolytic action.

But the present corrosion had produced pits with bright metal surfaces, identical to those observed in long, straight sections of tube taken from regular distributioon systems. This indicated strongly that the erosion-corrosion effects were in no way associated with stray currents, or to the electrolytic effect of dissimilar metal contact.

Other Factors Were Involved

Water being distributed in copper systems where failures were reported was generally highly softened, and contained dissolved gases. For example, at Michigan State, the water was sodium zeolite softened and rich in oxygen and carbon dioxide. Here, the water was heated after softening and circulated through the buildings by pumps. There was no removal of or control of dissolved gases (oxygen, carbon dioxide, nitrogen, etc.) found in the raw water.

The nature of the corrosion indicated that either carbon dioxide or oxygen, or both, were probably involved in the

(Continued in box on next page)

Attempts have been made to reduce erosion-corrosion in the critical temperature and velocity ranges which will occur in using sodium zeolite softened water. Tests on blends up to 60 and 110 ppm hardness were conducted[4] and the use of these blended waters did reduce corrosion. However, with 110 ppm blended water in the 140 to 200 F temperature range, heavy carbonate deposits were formed. Such deposits greatly increased flow resistance and decreased the heat transfer rate in booster heaters.

It was necessary to chemically clean the heaters frequently to maintain the desired operating temperatures. Inspection of the tube surfaces after the heavy deposits were removed showed small round pits, indicating that this type of aggressive action can cause corrosion even under heavy calcium carbonate deposits.

Use Data as Design Guides

The data and curves in References 4 and 5 should be used as guides by engineers designing copper hot water service distribution systems. These curves show the variation and corrosion rate of copper as a function of temperature and velocity for sodium zeolite softened water, various blends of hard water with sodium zeolite softened water, and water with various dissolved gas contents. A study of the tables will

— a resume of why and how

erosion-corrosion process.

Casual examination of corroded tube through which water had flowed at different velocities and temperatures suggested that these two factors were also involved. Observations of heat exchanger tubes showed erosion-corrosion effects due to temperature, velocities, water quality, equipment design, etc.

Launch Research Program

After many discussions by staff members of Michigan State University and the Copper & Brass Research Association (CABRA), an extensive research program was begun on the University campus.

The program had two facets. One was to learn the reasons why accelerated corrosion occurs in copper tube used for water distribution systems. This phase of the problem, since it was concerned with the fundamental behavior of copper and its alloys in contact with various waters, was a joint study sponsored by CABRA and the University.

The second facet concerned methods of alleviating and controlling corrosion, and of determining optimum operating conditions in the Michigan State University water distribution systems. Since this was basically a local problem, that phase of the project was sponsored by the University.

The Study Begins

In the first phase of the study, ASTM-NDHA copper corrosion test units, strip test units, and field test panels were used to gather pertinent information about corrosion rates. Data on velocities, temperatures, water quality, etc., was also obtained. These test units and field panels were installed in both the cold and hot water distribution systems, in locations of both rapid and slow flow, in raw and treated waters, and in horizontal and vertical positions. Water was analyzed for hardness, pH, copper and iron pick-up, alkalinity, chlorides, dissolved solids and concentrations of carbon dioxide and oxygen.

The results of the use of these test panels and testers have been reported in References 1 and 3. This method of testing is a very useful means of monitoring for the amount, rate, type and seriousness of corrosion as well as for an indication of any success brought about by a change in operating conditions for study purposes.

To study the factors affecting copper corrosion under actual service conditions, a number of mechanically identical experimental pilot plants were designed and operated. Known as main test panels, these plants permitted study of the effects of water of determined qality at six different temperatures — 50, 80, 110, 140, 170, and 200 F — and five velocities — 1.5, 2.3, 3.9, 8.1, and 13.1 ft per sec.

Metals or alloys studied were initially copper, then red brass, admiralty and cupro-nickel 10 percent. Waters of different quality were employed, including sodium zeolite softened, sodium zeolite softened water blended back to 60 ppm hardness, and sodium zeolite softened blended back to 110 ppm hardness. All the water used for the test panel experiments came from the North Reservoir, which was isolated from the campus distribution system.

No direct chemical treatment of the water in this reservoir was carried on during the test period.

Detail Combinations for Tests

Most of the main test panels were in operation continuously for 498 days, except for periodic disassembly and observation which was done every four months. The detailed final observations on the main test panel studies are recorded in References 3, 4, 5, and 6.

Table 1 shows the metals or alloys and water qualities used in the tests. Obviously many other combinations could have been employed. These were recommended by personnel involved in the studies. Each combination requires long continuous operation, large amounts of heat and volumes of water, and great numbers of analyses and tube measurements. Necessarily then, the practical number of tests which can be conducted is restricted.

Chemical Changes Also Studied

While it is true that the major share of this corrosion study was devoted to pilot plant experiments using main and field test panels, and to the other test units mentioned earlier, nevertheless some surveys on the fundamental chemical changes involved in corrosion were made. CABRA Progress Reports Nos. 6, 7, 8, and 10 (these are covered in Reference 12) plus some of the experimentation constitute data presented at the University as a Master's thesis.[8] Some statements from this thesis are included in the article in Reference 5.

The experiments employed open and closed systems, oxygen-content and oxygen-free waters, ranging from highly pure through various chloride, carbonate, bicarbonate

confirm the use limitations we have discussed.

Copper tube has satisfactory corrosion resistance for hot and cold water service distribution systems when used within these design limitations, for the water qualities indicated. Copper tube is the most satisfactory material available for such applications.

Admiralty and Cupro Nickel 10 Percent

Admiralty and cupro nickel 10 percent alloys were investigated primarily as substitutes for copper in heat exchanger tube where adverse water quality, temperature, or velocity conditions could not be avoided. Results of the study showed both these alloys to be superior to copper and red brass in heat exchangers under the most severe conditions of temperature, turbulence, and velocity.

Admiralty tube in 170 F service showed excellent erosion-corrosion resistance to sodium zeolite softened water containing appreciable oxygen and carbon dioxide, at all velocities up to the 13.1 fps maximum tested.

Admiralty tube was satisfactory up to the maximum temperature tested (200 F) as long as velocity did not exceed 8 fps. It resisted the turbulence effects in these ranges and therefore should be superior to copper tube in high temperature booster heat exchangers where high velocities, high temperatures,

tests were conducted, cont.

concentrations, solutions which were alkaline, neutral, and acidic, both high purity and commercial copper, and static and dynamic systems.

The Methods of Analysis

In evaluating erosion-corrosion studies, experimental data may be viewed from two aspects. First, one may make measurements of pit depths, loss of weight, and visual notes on the appearances of the samples. From these observations certain conclusions can be drawn.

Secondly, one may take a statistical view of the data from pit depth or other measurements. For example, having ascertained the number and kind of pits for a specified area, one may ask such questions as "What would be the probable time before a perforation would occur in a specified length of tube," or "How many ft of tube would be needed for a probable perforation in a specified length of tube?"

In our earlier articles, practically all of the emphasis has been on the first of these two approaches. Nevertheless, a brief statistical study was utilized, i.e. Reports Nos. 8 and 9 to CABRA as noted in Reference 12, for a Master's thesis at the University.[9]

This statistical approach employed the "Extreme Value" theory and was applied to the corrosion data by measuring pit depths for specified areas. Although not too conclusive, the study gave an approximate idea as to the length of the tube necessary to obtain a perforation or failure.

For example, it was indicated that a 1.67 mile length of $\frac{3}{8}$ in. diameter tube, through which water of zero hardness and 170 F was passing, would suffer one perforation in 500 days. Also, the study suggested that water of zero hardness at 80 F would not cause a perforation in any finite length of tube in 500 days.

This brief statistical study implies that the scope of Champion's correlation method[7] is too limited, that the statistical method can be applied to the data for corrosion of copper tube, and that the data on maximum penetration may not be representative of the pit distribution.

Although some observations of the measurements made would indicate that shorter test sections might be used in the main test panels, the statistical survey implied that the sections were too short, that "the sample was too small to produce failure in the minimum time period."

The experiments reported in the previous articles were not designed specifically for statistical studies, yet it can be pointed out that a statistical attack on the problem of erosion-corrosion could be feasible.

In another Master's thesis[10] X-ray diffraction study results for identifying corrosion products and X-ray radiography for pit depth measurements were employed. The diffraction studies showed the presence in different samples of cuprous oxide (on all lower temperature tube) of cupric oxide (on the 200 F samples) of basic copper carbonate, calcium carbonate, and possibly silica and iron oxides.

The more important use of X-rays was in the radiographical method for determining pit depths. This procedure is described in detail in Reference 10. The method, provided appropriate X-ray equipment and densitometers are available, can result in fast, accurate over-all determination of the extent of corrosion. It provides a permanent record of the profile of the surface scanned.

TABLE 1 — COMBINATIONS of tube material, water quality, and test periods employed in the main test panel experiments at Michigan State University

Tube material	Water quality	Test period, days
Copper	zero softened sodium zeolite water	498
Red brass	zero softened sodium zeolite water	632
Copper	lime-soda	324
Copper	lime-soda, sodium zeolite	324
Copper	sodium zeolite deaerated water	498
Copper	sodium zeolite blended back to 60 ppm hardness as $CaCO_3$	498
Copper	sodium zeolite blended back to 110 ppm hardness as $CaCO_3$	498
Cupro-nickel 10 percent Admiralty	sodium zeolite	498

What This Data Means to the Designer

LET US REPEAT that the factors to be considered in designing copper and copper alloy distribution systems are water velocity, water temperature, water quality, and the service demands on the system. Any two of the first three variables control the effect of the others.

In designing the system, the engineer should first learn the quality of the available water, and determine whether or not it is suitable for all the intended uses. From data on hardness, pH, alkalinity, dissolved gases, total solids, etc., and from anticipated temperature and velocity, he can determine if the operating conditions will be in the range of satisfactory performance imposed by these factors.

Preferably he should design for higher temperatures and lower velocities, rather than for the reverse. For less aggressive waters, it is suggested that water velocities not exceed 8 fps, nor temperatures 150 F. For more aggressive waters, velocities should not exceed 4 fps.

When water velocities and temperatures cannot be maintained within these limits, then the water quality (the aggressiveness of the water) must be modified to prevent erosion-corrosion.

Waters of 60 ppm total hardness are less corrosive than zero hardness waters, as indicated in Reference 4. To learn whether a system is operating properly, monitoring by test units, test strips, and field panels can indicate whether or not the system is being attacked[3]. If erosion-corrosion appears to be taking place, and the velocities and temperatures cannot be changed, the engineer may make the water less aggressive by adjusting the free carbon dioxide and pH of the water, by means of sodium carbonate or sodium hydroxide. Or he may blend some hard with zero hardness water to give a moderately hard water with a mild scale-forming tendency. In other words, he will produce a water of slightly positive Langelier index.

Removal of dissolved oxygen and carbon dioxide by deaeration is also a possibility. The effects of hydrogen sulfide or of ammonia were not investigated, but these are present in some waters and must not be overlooked. The engineer can use any one of several methods, or combinations, to give a suitable water, including chemical treatment with silicates, phosphates, etc., deaeration, and ion exchange.

Undue turbulence in the piping system must be prevented, and harmful stray currents or galvanic couples avoided. The installation of the tube, of course, must be in accordance with high standards of workmanship, including preflushing and cleaning of the system prior to service.

Very little has been reported about the service demands on a distributing system. In planning a system, the *ultimate* demands must be kept in mind. It is obvious that water velocities will be greatly affected for instance, if a dormitory which originally housed 500 students later is changed to accommodate 900 without a change in the water system.

Water treatment alone will not completely prevent erosion-corrosion effects due to excessive velocities and temperatures, with some waters. Nevertheless, practical experience has shown that with waters free from aggressive qualities, temperature and velocity effects are relatively unimportant.

By keeping within the indicated limits of water quality, temperature, and velocity, copper and copper alloys will produce extremely good service in hot and cold water distribution systems.

or water quality cannot be altered.

Cupro nickel 10 percent tube showed no erosion-corrosion effect at any temperatures (up to 200 F) or velocities (up to 13.1 fpm) with sodium zeolite water containing appreciable oxygen and carbon dioxide; therefore it should be an excellent alloy for booster heat exchangers where water quality, temperature, or velocities cannot be altered. ∓

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Multi-Use School Has Multi-Zone Heating

A 12-zone radiant ceiling panel design makes this school's heating system as serviceable as the building itself —

By W. M. HARJU
Chief Engineer
Swanson Associates, Inc.
Architects

MODERN SCHOOL designs, which frequently include an array of facilities for extra-curricular and community activities, offer a challenge to the engineer who must make the heating system as serviceable as the building itself.

This means a high degree of flexibility, with economy, in a number of areas which will be used for different purposes. To reach this goal, the heating system must be zoned and controlled in such a way that each use-area will be provided with the amount of heat it needs and equally important, when it needs it.

The system designed for the Woodrow Wilson Junior High School in Wyandotte, Michigan, provides flexible heating service for a multi-use building by means of a combination steam-hot water design with pneumatic day-night controls.

Layout, Zoning

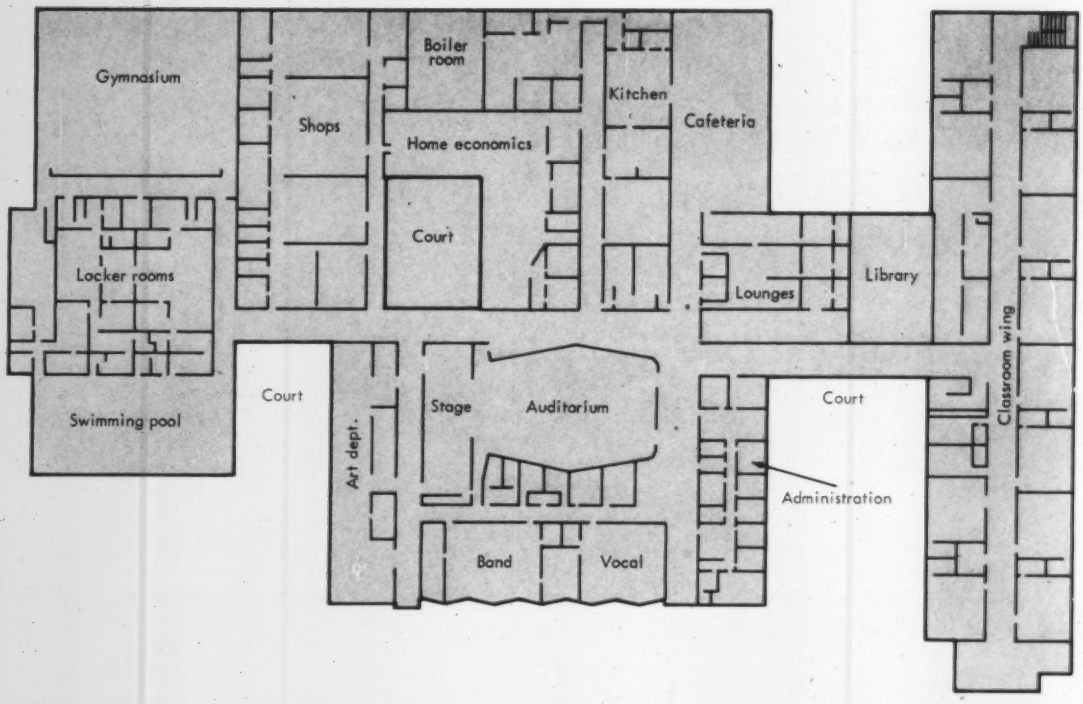
The school is designed for a normal occupancy of 900 students. A two story classroom wing adjoins the basic one-story part of the structure. (Fig. 1)

Heating and ventilating in the building is divided into 12 individually controlled zones, with the main temperature control panel located in the boiler room, from which point the engineer can exercise control over the entire system.

The heat source is comprised of three 200 hp packaged steam generators, oil fired with a No. 5 grade fuel and operating at a pressure of 9 to 12 psig. Each of the generators was completely equipped with safety and combustion controls before installation.

Single Condensate System

The three boiler feed pumps are connected to a single large condensate receiver tank which in-



WOODROW WILSON JUNIOR HIGH SCHOOL, Wyandotte, Mich., has hot water radiant ceiling panels, steam heating ventilating units, multiple zoning to serve variety of use areas

corporates a water make-up system. Thus, within the boiler room there is a single self contained boiler-pump unit system.

Two 20,000 gal underground fuel storage tanks are anchored to a reinforced concrete pad just outside the boiler room. A fuel oil pump and heater set with steam heat exchanger circulates and heats the oil delivered to the burners. Excess oil is returned directly from the burners to the tanks, and by this means a certain amount of additional preheating is gained.

Zone Supply

Steam from the packaged generators is distributed via pipe tunnels beneath the grade floor of the building to 12 mechanical equipment rooms. Here, steam to hot water converters transfer heat to the water medium used to supply radiant ceiling panels with acoustic control in the 12 zones.

"General" spaces within the building, such as offices, classrooms, the library, and cafeteria, are equipped with hot water radiant ceiling grids. Each room has its own thermostat, which controls a modulating type packless water flow control valve. This type of valve was selected in order to eliminate the possibility of leaks above the ceiling construction.

Ventilation

The outside air for these spaces is supplied through combination heating-ventilation units. These act as supplemental heating systems to provide morning temperature pick-up, since the entire system is designed around the night set-back principle.

When the system is activated in the morning, outside air dampers are closed, allowing air to circulate through the steam coils in the ventilating units. As the room temperatures approach the demand condition, a return air thermostat opens the outside air dampers, allowing air to be introduced to meet the school ventilation requirements with a minimum interior temperature of 70 F.

At the other end of the day, these ventilating units are shut down at a predetermined time, and the radiant ceiling system thermostats are reset to a lower temperature for the night cycle.

Specialty Areas

Gymnasium, auditorium, locker rooms and shop areas are heated by means of similar ventilating units. These are controlled by master thermostats set for day-night operation, plus submaster duct thermostats which act as automatic governors to prevent cycling of the steam valves at the heating coils.

A mixed air thermostat in the ventilator mixing box admits a specific quantity of outside air to the system during the normal day's operation. At night, outside air is shut off and the system is operated with 100 percent recirculated air at a reduced temperature and on intermittent fan cycle.

Controls for these systems also provide morning pick-up, by preventing outside dampers from opening until spaces have reached a predetermined temperature.

Swimming Pool, Kitchens

A radiant ceiling system is installed in the swimming pool enclosure, and is supplemented by an outside air ventilating system.

Outside air dampers and a roof exhaust fan are controlled by a hygrostat located in the return air duct to maintain the relative humidity in the space at 50 percent or less. Minimum supply air temperature is maintained at 80 F by a duct thermostat. The air supply ventilator is shut down at night.

For the kitchen area, a room and discharge air control system admits 100 percent outside air during the day, for exhaust through the canopies above the kitchen equipment. At night, exhaust fans are turned off and the outside air damper closed. With the recirculating air damper in the open position, the fan is operated continuously at a reduced supply air temperature.

Freeze Protection

Freeze protection thermostats are located downstream of the heating coil in the kitchen unit. These can shut down both the ventilator and exhaust fans during the day cycle.

Toilet room exhaust fan and damper controls are connected with the various zone day-night systems. This arrangement stops the fans for these spaces automatically on the night cycle. This offers a simple means of controlling the exhaust fan operation without the need for additional circuits. ≠

The editors wish to acknowledge the cooperation of Burgess-Manning Co. in the development of this article.

COMBINATION steam heating-ventilating units for auditorium are controlled by master thermostats set for day-night operation

SWIMMING POOL wing is equipped with hot water radiant ceiling, unit ventilators. Intake dampers and roof exhaust fan are regulated to maintain relative humidity at 50 percent or less

tricks and trends

LESTER T. AVERY, author of this feature, is president of Avery Engineering Co., Cleveland air conditioning contractor, and member of Heating, Piping & Air Conditioning's board of consulting and contributing editors. On this page, he reflects on his installation experiences.

Heat Pump Controls Need Careful Design Attention

THERE is a trend toward the heat pump method of heating for larger installations, and there are tricks in getting optimum performance from these units. It's something like a small miracle to see the conventional cooling system change itself over automatically from cooling to heating, then to reverse itself for defrosting and again supply heat — all without a button being pushed.

A recent installation in Ohio uses an air-to-water system of 80 tons cooling capacity, which serves 30,000 sq ft of basement and first floor in a modern, well managed department store.

Lights Ease Load

Here, the lighting load is sufficient to heat the store during working hours down to an outside temperature of 25 F. Below that point, additional heat is needed, and this comes from the heat pump.

When the store is closed at night and over the week-end, all heating is supplied by the heat pump. This balance has worked well in zero weather.

Defrost A Problem

An early problem appeared in connection with the defrosting operation during the heating cycle. Installation of the unit was in accordance with the recommendations from the heat pump manufacturer, and included a time clock to start the defrosting, plus a thermostat located on the bottom of the evaporator coil to terminate the cycle.

The difficulty arose when the thermostat became covered with steam, water, ice, etc., and would not function properly. We decided that it was the wrong type of thermostat in the wrong location, and a change was needed.

Revise Control

The thermostat has now been disconnected, and defrosting periods are ended by means of the same time clock that starts the operation. The cycle is set up for seven minute operation, and occurs six times a day. This keeps the coils clear. A longer defrost cools the water to the point that the room air begins to chill — a shorter one won't melt the ice.

Obviously, we are defrosting occasionally when there is no frost, but we don't have to continually change the clock. This condition could be corrected with another control which operates by differential pressure, so that at any outside ambient temperature, defrosting is started when the suction temperature drops below a preset differential.

Check Valves Fail

Another problem concerned the use of check valves on the liquid outlet lines from the condenser. These were intended to prevent liquid from flowing back into the evaporator when the system reversed from defrost to heating. The valves leaked, but in an irregular pattern — sometimes holding and sometimes not.

The proposed correction for this situation is to install a solenoid valve on the liquid drain line to match the one on the liquid supply line to the expansion valves.

Other Cautions

Some other points to be watched in designing a heat pump system involve the handling of surplus liquor in a slug eliminator, the design of the heat exchanger, and the process of reversing the unloader control whereby a compressor which normally unloads during cooling conditions does not unload during the heating operations.

These problems will not be encountered with installations where outside ambient temperatures remain above the freezing point, as demonstrated by the job in question during the spring and autumn months.

When the compressor stops under thermostatic control with the outside ambient temperature above 35 F, the evaporator defrosts during the off period. Heat pumps can and will heat at low temperatures but require special controls. ≠

Sectional Committee Interprets Code for Pressure Piping

● Since the Code for Pressure Piping, ASA B31-1955, was last issued, the Sectional Committee on the Code has been asked to interpret various statements contained therein. While these cases represent the opinion of the committee, they will not become parts of the Code until formal actions have been taken. Cases No. 32 and 49, below, cover the use of carbon steel, low alloy and austenitic stainless pipe for petroleum refinery piping and the application of this same section of the Code for chemical process industry piping. Case No. 50 deals with allowable stress which can be used for piping materials for which no specific values are listed in Section 1.

PENDING revision of the Code for Pressure Piping, ASA B31-1955, the Sectional Committee B31 has recommended that the American Society of Mechanical Engineers, as sponsor, make available selected interpretations of the Code. These interpretations do not constitute a part of the Code until formal action has been taken, but may be used by the industry as representing the considered opinions of the Committee.

Case No. 32 (Reopened)

Inquiry: Is the use of centrifugally cast carbon steel, low alloy and austenitic stainless pipe permissible under ASA B31.3-1959, Code for Pressure Piping?

Reply: It is the opinion of the Committee that centrifugally cast pipe is suitable for use in piping systems under ASA B31.3-1959, Code for Pressure Piping, if the following requirements are met:

1) The pipe materials shall meet the requirements of ASTM Specification A216, A351, A426, or A426 modified to exclude the requirements for ultrasonic in-

spection.

2) Piping made of materials conforming to A216 and A351 shall have both the inner and outer surfaces machined to a finish not coarser than 250 RMS after heat treatment.

3) Each piece of pipe made of materials conforming to A216 and A351 shall be examined on the inside and outside surfaces by a magnetic particle method or a liquid penetrant method of surface inspection which ever is feasible for the material after machining of the inside and outside surfaces, including the ends and after hydrostatic test. When magnetic particle inspection is used, it shall be made in accordance with the Method for Dry Powder Magnetic Particle Inspection (ASTM E109), or by a wet method agreed upon by a manufacturer and purchaser. The details of the liquid penetrant method shall be a matter of agreement between the manufacturer and purchaser. Any crack-like or other injurious defects revealed by these methods shall be repaired.

4) When specified in the engineering design, each piece of pipe shall be ultrasonically or radiographically tested throughout its length after machining to determine its soundness. When pipe is tested ultrasonically, discontinuities in excess of 5 percent of the wall or thickness shall be cause for rejection or repair. Either the shear or longitudinal methods of ultransonic testing shall be used. When pipe is tested radiographically, defects as judged by the industrial radiographic standards for steel casting (ASTM E71, Class II) shall be cause for rejection or repair. (It should be recognized that austenitic casting may not be amenable to ultrasonic inspection.)

5) Each length of pipe made of material conforming to Specification A216 and A351 shall be tested after machining by the manufacturer to a hydrostatic test pressure which will produce in the pipe at atmospheric temperature a stress of 60 percent of the specified minimum yield strength. This pressure shall be determined by the formula:

$$P = 2st/D$$

where:

P = minimum hydrostatic test pressure (psi)
s = 60 percent of the specified minimum yield strength or yield point.
t = actual wall thickness, in.
D = outside diameter of pipe, in.

The test shall be maintained for not less than five (5) minutes.

6) Flattening tests on pipe intended for bending shall be as prescribed in Specification A426-58T with following values of "e" to be used where applicable:

A216	0.07
A351 (austenitic)	0.09
A351 (ferritic)	0.07

7) The wall thickness of the casting shall be determined in accordance with the applicable paragraphs of Chapter II, Part 2 of the ASA B31.3-1959 Code except that the permissible stress values shall be as shown in the appended table. To arrive at the "S" value, the appropriate casting quality factors in Paragraph 8 below shall be applied.

NOTE: (The stress table should show the allowable stresses for materials without any casting factor.)

8) The following casting quality factors shall govern:

a) Minimum requirements of this case (including machining inside and outside plus magnetic particle inspection or liquid penetrant) . . 90 percent

b) 100 percent ultrasonic or 100 percent radiographic inspection in addition to requirements in (a) above, . . 100 percent

9) The foregoing requirements establish interim provisions for A351 and A216 until such time as further ASTM Specifications on centrifugally cast pipe become available and are accepted by the committee.

Case No. 49

Inquiry: Is there a Code Section of ASA B31 (Code for Pressure Piping) by which chemical process industry piping may be designed, fabricated, inspected and tested?

Reply: It is the opinion of the Committee that until such time as an ASA Pressure Piping Code Section specifically applying to chemical process piping has been published, chemical process piping may be designed, fabricated, inspected and tested in accordance with the requirements of ASA B31.3, Petroleum Refinery Piping.

Case No. 50

Inquiry: Section 1 of ASA B31.1-1955, Code for Pressure Piping, lists allowable stresses for only a limited number of piping materials. What stresses may be used for those materials listed in Table 1 for which no stresses are given?

Reply: It is the opinion of the Committee for Section 1 of ASA B31.1-1955, Code for Pressure Piping, that where it is desired to use materials mentioned in the above inquiry, the stresses given in the ASME Section 1, Power Boiler Code, apply. The intent of the Code for Pressure Piping will be met inasmuch as the basis for establishing stresses set forth in Table P-7 of the ASME Section 1, Power Boiler Code, has been adopted as the basis used under the requirements of Section 1 of the Code for Pressure Piping. ∓

Heat Transfer Nomograph Aids in Sizing Relief Valves For HTHW Water-to-Steam Converters

By H. A. DODGE, P.E.
Consulting Engineer

THE NOMOGRAPH on the following page may be used in quickly determining the size of relief valves for high temperature hot water heating systems. The chart has been based upon the following heat transfer equation which allows for the maximum theoretical heat transmission capacity of the coil in the system:

$$Q = AK(t_1 - t_2)$$

where

Q = heat transmitted, Btu per hr
A = heating surface of coil, sq ft
K = heat transmission coefficient, water to water, Btu per hr per sq ft per F and assumed to be 175 in the development of the nomograph
t_1 = supply high temperature hot water temperature, F
t_2 = saturation temperature of steam at relief valve set pressure, F.

The K coefficient value of 175 may be subject to question since the velocity of the high temperature hot water may not be known. However, it is felt that no great error can be made with the value of 175 Btu per hr per sq ft per F.

The relief valve should be sized to comply with the ASME Code requirements for steam boilers. In sizing the relief valve it is assumed that it will be able to accommodate the maximum possible heat transmission of the coil in the heat exchanger. A relief valve sized for a steam output at this maximum rate will certainly be more than adequate.

Example 1

Assume you require a capacity of 3,500,000 Btu per hr (3500 MBtu) and the supply high temperature hot water is to be 260 F (t_1). The saturation temperature of the steam at safety valve set pressure is 220 F (t_2), (17.2 psi Abs.).

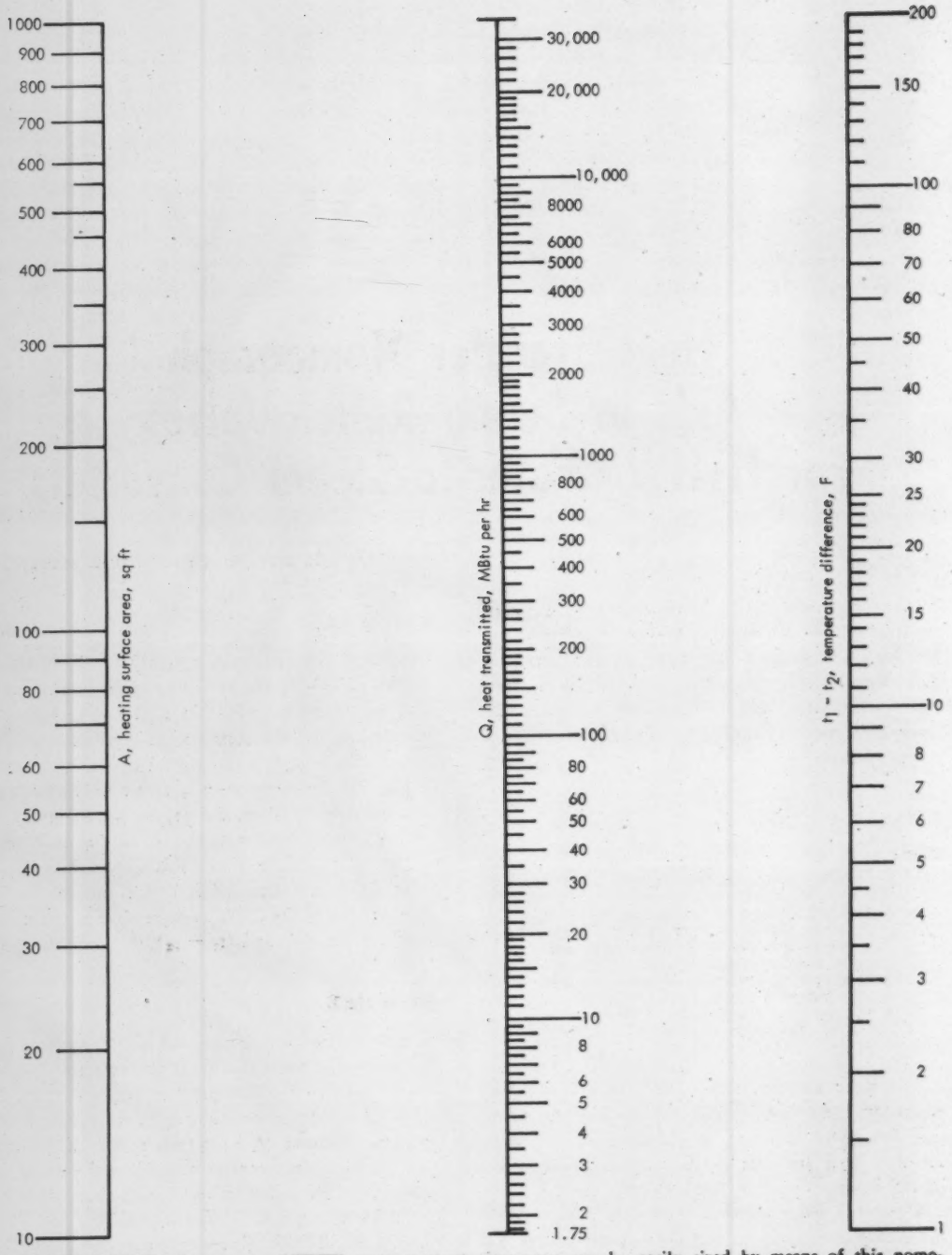
The difference between t_1 and t_2 is 40 F. A line drawn from 40 F on the $(t_1 - t_2)$ scale to 3500 on the Q scale intersects the A scale at 500, which is the sq ft surface of the coil required.

If different values of t_1 and t_2 are to be considered, use of the 3500 point as a pivot to find any combination of Q and $(t_1 - t_2)$.

Example 2

Now assume you have a coil of 500 sq ft surface. To determine the value of Q for any set values of $(t_1 - t_2)$ use the 500 point as a pivot and determine Q by the intersection of a line from 500 to various points of $(t_1 - t_2)$ on that scale.

(For more information regarding the sizing and installation of relief valves for these applications, see answer to question, *How Should We Size Relief Valves for HTHW Water-to-Steam Converters?* by W. M. Marcinkosi, January 1961, pages 144 and 146, and answers to this question by William T. O'Reilly and John A. Weber, October, 1960, pages 100 and 104.) ≠



RELIEF VALVES for use on HTHW water-to-steam converters can be easily sized by means of this nomograph. Origin and use of the chart is explained on preceding page

● Now that the "atomic age" has arrived, research and development activities in the nuclear field are expanding rapidly. More work is being done in more places, and some of these present particular difficulties to the engineer who provides air conditioning service to the research facilities. Extreme climatic conditions must be handled. In addition, radioactive materials work demands special provisions for air distribution and exhaust systems. This is the story of one research facility where heat pumps are being used to supply a tempered, safe environment for this important work.

Heat pumps, 79 zones, provide

Air Conditioning for Nuclear Research

By IRWIN KRANE
Senior Mechanical Engineer
Atomics International
Div. of North American Aviation, Inc.

THE AGE of nuclear research and development has placed new demands on heating and air conditioning engineers because of a continuing requirement for super-filtration and containment of the air surrounding radioactive materials.

Research in nuclear science is now carried out on a wide geographical basis, which means that in some areas, radioactive protection must be combined with year 'round air conditioning because of the local climate.

The San Fernando Valley, a residential suburb of Los Angeles, is the world headquarters location for Atomics International, a division of North American Aviation, Inc. Here the peak summer temperature may reach 115 to 118 F, but here is located a self-contained facility devoted to the design and manufacture of nuclear reactors for power production and research.

The complex consists of four major buildings, three of which are the principal subjects of this article.

The Manufacturing building, built a year and a half ago, covers 140,000 sq ft and is normally occupied by about 840 persons. It contains a warehouse, heavy machine shop, and facilities for pilot plant operations, plus mezzanine office space for materiel and technical groups.

The two-story Administration and Engineering building, used by about 850 people, has a total floor area of 107,000 sq ft. The plant's executive offices and conference rooms are in this building, together with space for the Canoga Park Area office of the U.S. Atomic Energy Commission.

Nuclear research work is accomplished in the 100 laboratories of a separate building; a two story structure similar in size to the administrative unit. Attendant office areas, libraries, computer rooms, and a special research and development machine shop fill the perimeter areas of this building.

A fourth structure handles personnel services. It embraces the facility's kitchen and cafeteria, plus offices for medical, security, and personnel groups. The normal complement of 80 people is increased to 500 during a typical lunch period.

Mr. Krane has had considerable experience in contracting in the heating, piping and air conditioning field before assuming his present position of senior construction engineer. He is professionally licensed in the State of New York.

Design Meets "Usual" Needs

Even though the expected peak summer temperatures are extremely high, as noted earlier, the design of the air conditioning system is based on the maintenance of an interior temperature of 80 F and 45 to 50 percent relative humidity when outside temperatures are 100 F DB and 72 F WB.

These weather conditions are not exceeded more than 20 percent of the time. To provide a margin of added capacity, equipment was selected on a 105 F ambient temperature basis. At a reduced capacity, the cooling equipment can operate up to an ambient

temperature of 115 F.

Winter design conditions are based on maintaining 72 F inside when the outside temperature has dropped to 30 F.

Choose Roof-Mounted Heat Pumps

Several objectives and load factors were considered in selecting the type of system to use. The first of these was the achievement of maximum productive space utilization for a "minimum" investment, consistent with a quality system. We were faced with the prospect of various occupancy levels in the general office areas, plus the number of laboratories with their high sensible loads from electrical equipment and lighting, plus the requirement for air containment and direct exhaust from areas in which radioactive materials would be handled.

Upon consideration of these factors, it was decided that roof-mounted, air-to-air heat pumps could best meet the requirements. Consequently, the design called for a total of 79 separate zones, and a total cooling capacity of 1100 tons.

Use Air Cooled Condensers

This design provides additional benefits and a number of savings. Added structural bracing requirements which might have been necessary with a larger central system were not required. The heat pumps utilize air cooled condensers, preferred for this installation over a water recirculation system.

Electrical power distribution equipment is mounted with the cooling units on the roof, thus reducing lost floor space, and in fact the roof location of the primary equipment means that a maximum of floor space is available for direct production purposes.

Multiple staging of the compressors means that maximum economy of operation can be attained because equipment can be operated at a capacity to suit the immediate need.

Self Contained Units Split Horizontally

A typical heat pump in the installation is completely self contained and is split horizontally. The lower fan section handles distribution of conditioned air to the spaces, while the upper condenser section draws air horizontally across the coils and discharges vertically. A removable panel at one end of the unit provides access to the multiple compressors, and a hinged opening allows access to the electrical controls grouped at one end.

The units include capillary tube refrigerant controls, and provide for thermostatically controlled automatic changeover for cycle selection, automatic defrost cycling to prevent icing during the heating cycle, and individual compressor isolation so that compressors may be serviced.

To provide the proper ventilation, a radioactive exhaust system has been incorporated in the laboratory building. This system exceeds the minimum AEC requirements.

All work on radioactive materials must be performed within chemical fume hoods, where a minimum face velocity of 100 fpm is maintained. The air requirement per hood establishes the exhaust air quantities for each laboratory module.

A total of 130,000 cfm of conditioned air is exhausted through 18 by 18 in. duct risers spaced every 24 ft in the laboratory area. Each riser serves two adjacent lab modules on each of the two floors, and can handle a maximum of 6250 cfm.

From the risers, horizontal 18 in. square duct runouts connect to round ducts and thence to the various fume hoods, glove boxes, or registers if no equipment is involved.

Ducts Are Over-Sized for Future Needs

To provide for future requirements, all ducts were made over-size to maintain present duct velocities of 1800 fpm but to allow for a maximum of 2500 fpm when needed.

After piercing the roof, the square risers convert to round ducts which are fed to one of several duct mains. Each main leads to one of seven house-like exhaust fan plenums, for filtering and discharge.

Two Filters Used to Trap Dangerous Particles

Two kinds of filters are used. First, 2 in. thick glass fiber pre-filters remove the major portion of particulate matter. This serves to protect the sub-micron filters. These are 12 in. thick, and provide additional filtering of sub-micron particles that might otherwise be bypassed.

Each exhaust plenum contains an airfoil type centrifugal fan which exhausts through a 12 ft high, vertical diffusion stack.

Six of these systems are for handling air of low-level radioactivity, and in these, filters may be replaced after the fans have been shut down.

The seventh is a "high level" exhaust system and must be dealt with in a different manner, since the fan for this system can never be shut down. To compensate for this, the exhaust plenum is split vertically, with filter banks on each side. The unit will handle a total of 25,000 cfm.

Isolation dampers serve to inactivate each side independently, allowing all the air to flow through the alternate side. The increased flow raises the system static resistance, which results in a reduced fan capacity. To circumvent this, a variable inlet damp-

LABORATORY ROOF, shown during air conditioning installation, supports series of self-contained air-to-air heat pumps, each of which serves separate zone. Larger house-like structures near center of roof are exhaust fan plenums used for filtering, discharge of air from radioactive material handling labs

er on the fan is opened to maintain the original capacity level.

All Exhaust Ducts Are Welded

All radioactive exhaust ducts are made of 16 gage galvanized steel, and all seams and connections are welded. Welding is required to provide leak-proof construction.

Because of the nature of the particulate matter, all branch connections must tie to mains either horizontally or from above, but never from beneath.

Air Movement Is Critical

Since the laboratory building also contains office areas, the relative room static pressures within the building must be such that all air flows from the perimeter offices towards the interior labs and ultimately to exhaust without recirculation.

In order to supply a maximum of conditioned air at the proper cooling level, it is necessary to maintain the supply air temperature at about 65 F. This represents the capacity limit at design conditions.

For additional capacity, we make use of the fact that the building is equipped with a hung ceiling. The space above serves as an auxiliary plenum, from which air is taken. Five packaged air conditioning units with a total capacity of 100 tons are capable of conditioning a total of 50,000 cfm of 100 percent outside air to provide the additional makeup air needed in the laboratories.

In order to insure the quickest possible response, controlling thermostats for these units are located within the hung ceiling plenum, in order to recognize changing outside conditions as early as possible.

On the other end of the scale, auxiliary electric strip heaters in the units are used to augment the heat pump capacity to temper outside air during the winter months.

Operation Meets Expectations

The nature of nuclear research and development work requires a constant alteration and adaptation of air conditioning and exhaust systems for this kind of facility. This flexibility, built into the system, has been more than justified. With several months of continuous operation already passed, the systems have functioned satisfactorily during a very extreme summer season.

The same operational satisfaction has been experienced during the recent cooler weather. ⧺

How to Balance and Test Air Handling Systems To Assure Satisfactory Performance

How to check and maintain performance of air distribution systems was discussed in a symposium at the recent meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers held in Chicago. Speaking before the group, James Bricker, consulting engineer, Charles E. Leopold Inc., stated that one of the final responsibilities of the consulting engineer on an air conditioning project is supervision of the testing of major system components and the duct system.

Standards for operation are set in the plans and specifications. During installation the contractor has submitted shop drawings and performance characteristics on each major piece of equipment. These documents are all essential when checking a system, he said, and the person conducting the tests must be familiar with all of them. The mechanical contractor and the consulting engineer have a dual responsibility in testing a system, Mr. Bricker continued, but the final responsibility of the design belongs to the consulting engineer, assuming the contractor has installed the system and provided equipment as specified and indicated on the contract drawings.

To facilitate testing and balancing of systems, Mr. Bricker's firm includes in the plans and specifications the instrumentation that will be needed during test. Flow meters are installed in pertinent water lines; thermometers, draft and pressure gages, and pitot tube stations are installed where required in the systems for testing purposes. Additionally, dampers are installed at key points in air systems to facilitate balancing.

At the beginning of the test of an air distribution system, a general inspection of the system was recommended by Mr. Bricker. This should include checking out dampers and their operators, observing the fan speed and rotation, and checking the ampere draw of the motors to be sure that ratings are not being exceeded.

Before fan performance can be tested, the supply fan discharge ductwork must be first balanced. Also, the automatic dampers throughout the conditioning apparatus on the suction side of the fan must be adjusted for the design air quantities. The balancing operation begins by locating the branch farthest from the fan. This is usually the most critical branch. This differs from the usual procedures, Mr. Bricker noted, where the fan discharge ductwork is balanced beginning at the fan and working towards the end of the duct system. The use of a pitot tube and draft gage for quantitative air flow measurement was recommended.

Five Steps To A Balanced System

The balancing procedure followed by Mr. Bricker consists of the following steps:

1) The total flow in the farthest branch is determined by a pitot traverse. Static pressures as well as velocity pressures are recorded since the static pressure can be used for qualitative system adjustments.

2) The terminal units supplied by this branch are adjusted to provide the design proportion of the flow in each unit. The units are balanced in relation to one another at the branch flow rate existing at the beginning of the test. The flow to each terminal for the measured branch flow is determined by the following formula:

$$Q_{tr} = Q_{td}\ (Q_{bm}/Q_{bd})$$

where

Q_{tr} = Terminal air flow rate required at test conditions, cfm
Q_{td} = Terminal air flow rate at design conditions, cfm
Q_{bm} = Branch air flow rate measured at start of test, cfm
Q_{bd} = Branch air flow rate at design conditions, cfm

3) When the terminal units are properly balanced relative to each other, the branch duct is adjusted to achieve the design air flow in the branch. The static pressure at design flow is recorded and this basic static pressure requirement is used as a reference while the remaining branches are balanced.

4) Proceeding toward the fan, the terminals in the next branch are balanced by the procedure outlined in step 2. After the units of the second branch are balanced relative to each other, the branch is ad-

justed for design flow while maintaining the basic static pressure requirement for design flow to the critical branch previously adjusted.

5) Step 4 is repeated until every branch is balanced, always referring to the basic static pressure reference required for the critical branch duct.

Once the design air flow rate has been set, Mr. Bricker explained, the static and velocity pressures are recorded. Then the various modulating dampers in the air conditioning unit and return system are adjusted. This is accomplished by setting the dampers in positions ranging from fully opened to fully closed. After all damper adjustments are made, the final adjustment of fan speed is made to obtain the design flow. Then, and only then, the performance of the main supply fan is checked against its rated performance. This assures that the performance data apply to the conditions of operation.

Before starting the test of the refrigeration system, Mr. Bricker suggested it is well to check all safety controls and accessories, the location of all instruments to be sure the desired variables are being recorded, and to check that all thermometers are properly inserted in the wells provided.

Test Chiller Under Steady Conditions

When testing the refrigeration system, Mr. Bricker cautioned, the system must be operating under steady state conditions. In many cases, it will be necessary to impose a load on the system to obtain steady operation near design conditions. When testing the chiller, it is essential that the chilled water return temperature be at the design value and that the condenser leaving water temperature is also at design. A load can be imposed on the chiller by the use of more outdoor air through the cooling coil, or by use of a preheater, if available. The leaving design condenser water temperature can be approached by reducing the quantity of water being circulated. Similar procedures are followed in checking the cooling tower and individual coils. If the refrigeration cycle tests favorably at full load, it is desirable to check the system out at reduced loads.

Since it is usually impossible to check all portions of the system simultaneously, Mr. Bricker said his firm checks major components individually. For example, the condensing unit and evaporator are checked as one unit, and the cooling tower as another. However, complete logs are kept on other components during the test of any major unit.

The instrumentation needed for balancing and testing a system in addition to those installed in the system includes laboratory test thermometers (0.1 F scale divisions), a barometer, draft gages, pitot tubes, sling psychrometer, clamp-on ammeter, and a voltmeter.

The discussion following Mr. Bricker's talk centered mainly about the limited capability that some, otherwise competent, contractors have for balancing and testing a system. Mr. Bricker agreed that some contractors cannot balance and adjust a system and, for this reason, his firm directs all test work on the jobs they design. Going one step further, he noted that his firm often conducts the necessary testing and balancing because it is expedient to do so.

When questioned from the floor about the charges made for this service, Mr. Bricker replied that no special charge was made. However, he indicated their responsibility for test is taken into account in their normal fee. It was pointed out that firms have been established in several areas which provide balancing and testing services.

Another question directed to Mr. Bricker from the floor was: In your experience, what approach do you find best to get across a new idea to the client? In such circumstances, Mr. Bricker answered, his firm had been successful when they explained the system to the operating personnel — "the fellows in the boiler room."

Field Testing Industrial Exhaust Systems

We are concerned with the evaluation of the exhaust system performance in this discussion, K. E. Robinson, staff ventilation engineer, General Motors Corp., stated in opening his talk. Evaluation of contaminate control will not be considered though the latter is a vital part of evaluating total exhaust system performance.

It must be recognized, Mr. Robinson said, that system performance cannot be evaluated in the field with the same precision or degree of accuracy that is obtained in the laboratory. Thus, the first step in field evaluation of a system is to agree on the data that is to be collected and the degree of inaccuracy that will be tolerated.

Three reasons why testing of industrial exhaust systems is important were cited by Mr. Robinson:

1) It is the only way to determine if the equipment and installation satisfy the plans and specifications.

2) It provides experience for the designer and shows how well design procedures work.

3) It serves as a sound foundation for preventive maintenance and future system adjustments and modifications.

There are many methods of measuring air flow and many instruments available for this purpose, Mr. Robinson observed. Some of these are too com-

plex and too sensitive for field tests. As a result, frequent calibration is required to obtain dependable data. Many engineers favor the use of a pilot tube and draft gage because they are simple, rugged, and require no calibration. Combination inclined and vertical draft gages, which are held to the duct with magnets, offer reasonable accuracy over a wide range of velocities and are convenient to use. Flexible "U-tube" gages which can be rolled up and carried in a pocket are also convenient to use when ducts are located in hard to get at places and static readings will be satisfactory.

Locating suitable sampling stations in exhaust systems is sometimes difficult. Accepted practice should be followed and whenever possible the measuring station should be as far down stream as possible from any air stream disturbances such as elbows, and branch entry fittings. A distance of 7 to 10 pipe diameters is desirable but cannot always be obtained, Mr. Robinson explained. Accepted pitot traverse methods must be used to obtain satisfactory data.

To illustrate what information should be recorded Mr. Robinson exhibited a typical log sheet used by his company. Included in the log was pertinent information locating the system within the plant, nameplate and performance data on the principal components, and the air flow test data.

When evaluating the performance of the fan, Mr. Robinson noted that the static pressure at the inlet and the total pressure at the outlet must be determined. A common mistake, he said, is to measure only the pressure at the fan inlet.

How to Measure Branch Flow

A complete field evaluation of an exhaust system requires measurement of the flow at each branch. Oftentimes it is not possible to make a pitot transverse in a region free from air stream disturbance because of the size or configuration of the duct system. In such cases, Mr. Robinson explained, the flow in the branch can be determined by using the static pressure measured just downstream from the exhaust hood. Knowing the static pressure at this point and the entry coefficient of the hood under test (these values are available for common hoods) the air flow can be computed with reasonable accuracy.

When proving a balanced exhaust system, Mr. Robinson recommended that the measured air flow should be within 5 percent of the design value. A blast gate system should be adjusted to achieve the design flow and then the gates should be fixed in position either by locking or by welding. This prevents adjustments being made by anyone not familiar with the system.

Causes of poor performance of exhaust systems have been found from field tests to be due to fittings that deviate from the plans and specifications, leakage at joints, plugging of the system, and even to fans running backward. A system should not be released for continuous service by the engineering department, Mr. Robinson cautioned, until tests show that it is performing properly.

Test Data Can Minimize Maintenance

Field test data can be used to establish the performance of the various components. This provides useful design information and also promotes more efficient use of maintenance personnel as the performance data can be used to determine just the right amount of maintenance. Citing a dust collector as an example, Mr. Robinson pointed out that day-to-day checks of performance could be compared to the performance indicated during the preliminary tests to show when maintenance was required. In this way neither too little nor too much maintenance is carried out.

Mr. Robinson said it is considered good practice to test every exhaust system installed. First, because such tests assure management that the system is performing as intended. Secondly, because it helps the contractor to know that a system is going to be checked and in his experience the contractors want the systems checked because it assures them that a good job will be recognized. Finally, as noted earlier, the field tests help the ventilation engineer by providing data which can be used to develop and improve design procedures.

In closing, Mr. Robinson observed that some persons say that an engineer is not qualified to design an industrial exhaust system until he has had field test experience.

Air Volume Control for Industrial Ventilation

The ventilation system is the life blood of a process installation, R. J. Walker, plant and process engineering group leader, Dow Chemical Co., said, and it and the building housing it must be operated as an integrated whole. The primary purpose of the ventilation system is to assure proper air flow movement around the various processes to prevent contamination of the plant air.

Get a good system through design and installation, prove it out, and keep it operating as designed, Mr. Walker advised. Continuous, good air volume control is the key to keeping the ventilation functioning properly, he said.

Conditions leading to reduced air flow and un-

balance of an industrial ventilation system that is well designed and installed were listed by Mr. Walker as follows:

1) Dirt collects in the various components — fans, filters, ducts, etc.

2) Corrosion of metal parts.

3) Slipping belts, bearing wear, dampers which fail to operate.

4) Poorly maintained control systems.

5) Wind and snow affecting the outdoor air intake.

How to Control Volume

An air volume control which Mr. Walker has found satisfies his requirements employs a pitot tube placed to monitor the velocity in the fan discharge, a differential pressure controller, and inlet vanes on the fan. This is a simple control system, he said, which cures many ills and saves power by maintaining a constant volume. Constant volume control helps to meet wide variations in system requirements.

In Mr. Walker's system, air flow by design is from clean to dirty process areas. Air is supplied to the clean areas and exhausted from the dirty ones. This makes constant volume control essential, he said, because the air flow patterns must not be interrupted. Indicators installed at critical points in the system are helpful too, he pointed out, in determining that the entire system continues to function properly.

Three Speed Fan Reduces Costs

Departing from the considerations involved in constant volume control, Mr. Walker observed that step control of fan speed may produce the most economical ventilation system for certain process requirements. Citing the results of a cost study for the system in a plant that at 30 air changes required 1½ million cfm he showed how by proper use of the air it was possible to reduce the volume to 300,000 cfm. This was possible because the maximum volume requirement was based upon the time required to purge the plant in an emergency. Radioactive materials are processed in the plant so short purge time is necessary.

Continuous operation at the 30 air changes was expensive both in first cost and in operation and maintenance costs, Mr. Walker explained. By the use of three speed fan control it is possible to operate with the minimum air quantity (1/3 of maximum) during times when the plant is shutdown, 2/3 of the capacity when the plant is in operation to provide proper ventilation of the processes, and the full capacity in the event of an emergency.

It was found, he said, that the 3 speed fan control would pay itself out in just 18 months. A two speed fan providing the purge cfm in emergencies and that required during normal operation was found to pay out in two years.

Other benefits that accrue in addition to decreased heat load and running horsepower requirements are related to the cost of operating and maintaining the air filters. An approximate five fold increase in filter life is achieved due to the decrease in dust loading. Additionally, fewer filter changes reduce the exposure of the maintenance personnel to the radioactive materials collected.

In conclusion, Mr. Walker warned that every change in a plant or system must be considered because of its overall effect on the air flow patterns.

Testing Has Legal Implications

Commenting on testing of industrial exhaust systems from the floor, J. J. Burke, American Viscose Corp., said that testing has certain legal implications. Court rulings indicate that if a system is tested every six months the company will probably be considered "not negligent." On the other hand, he continued, if they have not been tested the company may be held criminally negligent.

Mr. Burke also stressed the need for locking dampers on exhaust systems. He has found it necessary to lock dampers and keep the keys in the foreman's office to prevent unauthorized adjustments. This is especially important in systems handling toxic or explosive fumes, he cautioned, and even when locked they should be checked frequently.

F. Ford, Chicago ventilation bureau, asked Mr. Walker whether submicron particulate filters were used on both the intakes and exhausts in hot rooms? Mr. Walker replied that they were not in his plant. In his designs an attempt is made to reduce dust loading to minimize filter maintenance and such filters are only installed in the exhaust. Mr. Ford questioned whether cross contamination was possible under such circumstances. Mr. Walker replied that the history at their plant was that the air leaving the plant had a level of radioactivity less than 10 percent the normal level outdoors. Similar low levels of radioactivity are measured in the plant at the breathing level, he said.

Another question from the floor was: Can makeup air brought to the face of a hood be justified economically and what percent of makeup air should one supply this way? Mr. Walker replied that in his opinion makeup air should not be brought to the hood face and stated that he has successfully managed to keep such arrangements out of his plants. His reason was that the velocity of the air moving into the hood is used to keep the contaminant from the worker. If air is brought into the hood by other means, he concluded, the proper velocity is not achieved in the critical areas. ∓

These direct-reading tables will let you

Calculate Solar Irradiation Rate For Forward-Inclined Walls

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JUST OVER 10 years ago, Heating, Piping & Air Conditioning published a series of three articles providing direct-reading tables for hourly determination of the solar irradiation rate on vertical walls during the winter months. Subsequently, similar data was published for the summer months.[1]

Five years ago, the solar irradiation rate data was presented for determining the solar irradiation rate on walls, skylights, or roofs which are inclined backward from the sun.[2]

This article is the first of a concluding series which presents all-year irradiation data for surfaces which are inclined *toward* the sun.

With the ever increasing need for accuracy in solar heating calculations and in air conditioning load computations, it now seems desirable to make available complete tabular data for the evaluation of irradiation rates for a surface facing in any direction (by interpolation or extrapolation) and inclined at any angle to or from the sun.

This article will deal with surfaces which face south and which are inclined either 15 or 30 degrees forward. Future tables will present data for east or west-facing forward inclined surfaces, and lastly for those facing southeast or southwest.

Example 1

To demonstrate the method of using the tables, consider a 15 degree forward-inclined wall facing south, in a structure located at latitude 40 degrees.

The wall is 15 ft high by 35 ft long. For a clear day in October, determine

a) The irradiation rate at 9 a.m.

b) The irradiation rate at 12 noon

c) The total quantity of solar energy striking the wall during the day

d) The average hourly irradia-

TABLE 1 — MAXIMUM HOURS OF POSSIBLE IRRADIATION for vertical walls, given below, may be modified for use in calculating for inclined walls by reference to the incidence angles given in accompanying Tables 1c, 2c, 3c, and 4c

South facing	Latitude, degrees			
	30	35	40	45
	Hours			
December	9.7	9.7	9.2	9.2
January	10.5	10.0	9.6	9.4
February	11.3	11.1	10.7	10.8
March	12.0	12.0	12.0	12.0
April	9.0	9.5	10.0	10.3
May	7.8	8.8	9.6	10.2
June	6.1	8.1	9.0	9.8
July	7.6	8.6	9.4	10.0
August	10.1	10.6	11.4	11.4
September	12.6	12.7	12.8	12.8
October	11.1	11.1	10.7	10.8
November	10.5	10.0	9.6	9.4
Southeast or southwest facing	**Latitude, degrees**			
	30	35	40	45
December	8.0	9.1	7.8	7.8
January	8.1	8.9	7.8	7.9
February	8.0	8.0	8.2	8.0
March	7.8	7.8	8.4	8.2
April	7.6	8.4	8.8	8.4
May	8.6	8.8	9.4	9.2
June	8.9	9.1	9.7	9.4
July	8.9	9.1	9.7	9.5
August	9.0	9.3	9.7	9.5
September	9.1	9.3	9.6	9.5
October	7.9	8.0	8.2	8.0
November	8.1	8.9	7.8	7.9
East or west facing	**Latitude, degrees**			
	30	35	40	45
December	5.0	4.9	4.6	4.6
January	5.3	5.0	4.8	4.7
February	5.7	5.6	5.4	5.4
March	6.0	6.0	6.0	6.0
April	6.5	6.5	6.7	6.9
May	6.8	6.9	6.9	6.9
June	7.2	7.2	7.2	7.2
July	7.2	7.2	7.2	7.2
August	6.9	6.9	6.9	6.9
September	6.4	6.4	6.4	6.4
October	5.7	5.6	5.4	5.4
November	5.3	5.0	4.8	4.7

[1]Irradiation of vertical walls was covered in two previous series: for the months October through April in the July, 1949, December 1950, and May 1951 issues of HPAC; those for the months May through September appeared in the issues of September, October, and November of 1954.

[2]Irradiation of backward-inclined surfaces was covered in a series of articles which appeared in the August, September, and October, 1955 issues of HPAC.

tion rate, sunrise to sunset

e) A comparison of the irradiation rate for part *d* with that for a horizontal surface in the same place at the same time.

Solution: a) Since the wall is located at latitude 40 degrees, Table 3c is applicable. From this Table, the irradiation rates at the same time of day in February and October are the same; hence the rate per unit area of 15 degree forward sloping wall at 9 a.m. in October is read from the fifth column as 129.8 Btu per hr per sq ft. Wall area is 15 ft × 35 ft or 525 sq ft, so the total rate of irradiation is (129.8) (525) or 68,145 Btu per hr.

To solve for the irradiation rate at noon, b) the fifth column yields a rate of 179.0 Btu per hr per sq ft, so the rate is 93,975 Btu per hr.

The total quantity of energy striking the wall during the day, c) is the average hourly rate multiplied by the actual hours of sunshine. Average rate equals 86.1 + 129.8 + 155.4 + 172.3 + 179.0+ 172.3 + 155.4 +129.8 + 86.1, all divided by 9, or 140.7 Btu per hr per sq ft.

Actual hours of sunshine on a clear day is given in Table 1, for a south-facing, latitude 40 degrees wall in October. It equals 10.7 hrs.

Thus, the total daily irradiation rate is (10.7) (525) (140.7) or 790,382.25 Btu per day.

The average hourly irradiation rate, d) between sunrise and sunset is the total from c) above, (790,382.25 Btu per day) divided by the actual hours of sunshine (10.7) or 73,867.5 Btu per hr.

For a horizontal surface, e) the irradiation rate comparable to that of part d) would be as given to the right in Table 3c, or: (60.0 + 111.5 + 154.1 + 179.5 + 191.7 + 179.5 + 154.1 + 111.5 + (60.0) × (10.7/9) × (525) or 750,193.5 Btu per hr.

Cosines in the tables have been calculated to four decimal places, but corresponding angles are given only to the nearest degree. ≠

Tables continue on page 152

South wall — **TABLE 1c** — Latitude 30°

Solar time	I_t	15° Slope forward			30° Slope forward			Horizontal		
		i	cos i	I_t cos i	i	cos i	I_t cos i	i	cos i	I_t cos i
December										
8am. 4pm	194.0	60	0.4947	96.0	67	0.3922	76.1	79	0.191	37.0
9am. 3pm	265.0	56	0.5561	147.4	66	0.4022	106.6	69	0.358	95.0
10am. 2pm	286.0	54	0.5911	169.1	66	0.3998	114.3	61	0.485	138.5
11am. 1pm	296.0	53	0.6083	180.1	67	0.3914	115.9	55	0.574	169.7
12 noon	298.7	52	0.6157	183.9	67	0.3907	116.7	53	0.602	179.7
Jan. or Nov.										
8am. 4pm	218.0	63	0.4545	99.1	70	0.3469	75.6	77	0.225	49.1
9am. 3pm	277.0	60	0.4967	137.6	70	0.3362	93.1	66	0.407	112.7
10am. 2pm	294.0	57	0.5502	161.8	69	0.3509	103.2	58	0.530	155.8
11am. 1pm	304.0	56	0.5648	171.7	70	0.3412	103.7	52	0.616	187.2
12 noon	308.0	55	0.5736	176.7	70	0.3420	105.3	50	0.643	198.0
Feb. or Oct.										
8am. 4pm	251.0	70	0.3373	84.7	77	0.2194	55.1	72	0.309	77.6
9am. 3pm	286.0	67	0.3831	109.6	78	0.2133	61.0	61	0.485	138.7
10am. 2pm	301.0	65	0.4207	126.6	78	0.2083	62.7	51	0.629	189.3
11am. 1pm	308.0	64	0.4362	134.3	79	0.1981	61.0	44	0.719	221.3
12 noon	313.5	65	0.4226	132.5	80	0.1737	54.4	40	0.766	240.2
Mar. or Sept.										
7am. 5pm	157.0	87	0.0516	8.1	*	*	*	76	0.242	38.0
8am. 4pm	223.0	84	0.1112	24.8	*	*	*	64	0.438	97.8
9am. 3pm	258.9	79	0.1824	47.2	*	*	*	53	0.602	155.6
10am. 2pm	274.6	78	0.2121	58.2	*	*	*	41	0.755	207.2
11am. 1pm	283.3	77	0.2326	65.9	*	*	*	32	0.848	239.4
12 noon	286.5	76	0.2419	69.3	*	*	*	29	0.875	250.8
Apr. or Aug.										
8am. 4pm	241.0	*	*	*	*	*	*	58	0.530	127.7
9am. 3pm	270.4	*	*	*	*	*	*	44	0.719	194.5
10am. 2pm	282.5	88	0.0300	8.5	*	*	*	33	0.839	237.0
11am. 1pm	289.4	88	0.0373	10.8	*	*	*	22	0.927	268.3
12 noon	290.0	87	0.0523	15.2	*	*	*	18	0.951	276.0
May or July										
8am. 4pm	252.2	†	†	†	†	†	†	54	0.588*	148.0
9am. 3pm	273.4	†	†	†	*	*	*	42	0.743	203.0
10am. 2pm	285.5	*	*	*	*	*	*	29	0.875	249.7
11am. 1pm	291.3	*	*	*	*	*	*	17	0.956	278.4
12 noon	293.0	*	*	*	*	*	*	10	0.985	288.5
June										
8am. 4pm	254.6	†	†	†	†	†	†	53	0.602	153.1
9am. 3pm	276.9	†	†	†	†	†	†	39	0.777	215.2
10am. 2pm	286.7	*	*	*	*	*	*	27	0.891	255.2
11am. 1pm	292.2	*	*	*	*	*	*	14	0.970	283.5
12 noon	293.1	*	*	*	*	*	*	6	0.995	291.5

*At these times the solar altitude is too high to permit irradiation of the wall.
†At these times the position of the sun is north of east or west, hence the wall will not be irradiated.

South wall — TABLE 2c — Latitude 35°

Solar time	I_o	15° Slope forward: i	cos i	I_o cos i	30° Slope forward: i	cos i	I_o cos i	Horizontal: i	cos i	I_o cos i
December										
8am, 4pm	179.0	59	0.5145	92.1	66	0.4142	74.1	80	0.174	31.1
9am, 3pm	239.0	53	0.6000	143.4	63	0.4594	109.8	73	0.292	69.9
10am, 2pm	267.0	49	0.6513	173.9	62	0.4747	126.7	66	0.407	108.6
11am, 1pm	279.0	47	0.6868	191.6	61	0.4855	135.5	61	0.485	135.2
12 noon	287.6	47	0.6820	196.1	62	0.4695	135.0	58	0.530	152.4
Jan. or Nov.										
8am, 4pm	196.0	61	0.4810	94.3	68	0.3799	74.5	79	0.191	37.4
9am, 3pm	268.0	57	0.5450	146.1	67	0.3922	105.1	69	0.358	96.1
10am, 2pm	287.0	53	0.6019	172.7	66	0.4136	118.7	62	0.470	134.8
11am, 1pm	294.0	50	0.6463	190.0	64	0.4372	128.5	58	0.530	155.9
12 noon	300.0	50	0.6428	192.8	65	0.4226	126.8	55	0.574	172.0
Feb. or Oct.										
8am, 4pm	245.0	69	0.3581	87.7	76	0.2426	59.4	73	0.292	71.7
9am, 3pm	282.0	66	0.4125	116.3	76	0.2480	69.9	63	0.454	128.0
10am, 2pm	297.0	62	0.4721	140.2	75	0.2655	78.9	54	0.588	174.5
11am, 1pm	303.0	59	0.5154	156.2	73	0.2858	86.6	49	0.656	198.8
12 noon	308.9	60	0.5000	154.5	75	0.2588	79.9	45	0.707	218.2
Mar. or Sept.										
7am, 5pm	157.0	86	0.0678	10.6	*	*	*	76	0.242	38.0
8pm, 4pm	223.0	81	0.1549	34.5	89	0.0213	4.7	64	0.438	97.8
9am, 3pm	258.0	76	0.2472	64.0	86	0.0678	17.6	55	0.574	148.4
10am, 2pm	273.4	75	0.2568	70.2	88	0.0309	8.4	42	0.743	203.2
11am, 1pm	280.8	73	0.2903	81.5	88	0.0406	11.4	35	0.819	230.0
12 noon	283.5	73	0.2924	82.9	88	0.0349	9.9	32	0.848	240.3
Apr. or Aug.										
8am, 4pm	241.0	*	*	*	*	*	*	58	0.530	127.7
9am, 3pm	267.7	88	0.0349	9.3	*	*	*	46	0.695	186.1
10am, 2pm	281.6	86	0.0717	20.2	*	*	*	34	0.829	233.4
11am, 1pm	287.2	83	0.1184	34.0	*	*	*	26	0.899	258.0
12 noon	289.1	83	0.1219	35.2	*	*	*	22	0.927	268.0
May or July										
8am, 4pm	252.2	†	†	†	†	†	†	54	0.588	148.2
9am, 3pm	274.6	*	*	*	*	*	*	41	0.755	207.4
10am, 2pm	284.8	*	*	*	*	*	*	30	0.866	246.7
11am, 1pm	290.2	*	*	*	*	*	*	20	0.940	272.5
12 noon	291.8	*	*	*	*	*	*	15	0.966	281.6
June										
8am, 4pm	256.7	†	†	†	†	†	†	52	0.616	158.0
9am, 3pm	276.9	*	*	*	*	*	*	39	0.777	215.0
10am, 2pm	286.7	*	*	*	*	*	*	27	0.891	255.4
11am, 1pm	291.3	*	*	*	*	*	*	17	0.956	278.5
12 noon	292.5	*	*	*	*	*	*	12	0.978	286.0

*At these times the solar altitude is too high to permit irradiation of the wall.
†At these times the position of the sun is north of east or west, hence the wall will not be irradiated.

South wall — TABLE 4c — Latitude 45°

Solar time	I_o	15° Slope forward: i	cos i	I_o cos i	30° Slope forward: i	cos i	I_o cos i	Horizontal: i	cos i	I_o cos i
December										
8am, 4pm	168.0	58	0.5337	89.7	64	0.4364	73.3	81	0.156	16.3
9am, 3pm	194.0	48	0.6665	129.3	57	0.5462	106.0	79	0.191	37.0
10am, 2pm	215.0	39	0.7729	166.2	51	0.6323	135.9	77	0.225	48.4
11am, 1pm	251.0	36	0.8077	202.7	50	0.6410	160.9	72	0.309	77.6
12 noon	260.0	36	0.8090	210.3	51	0.6293	163.6	69	0.358	93.3
Jan. or Nov.										
8am, 4pm	154.0	59	0.5128	79.0	65	0.4222	65.0	82	0.139	21.4
9am, 3pm	218.0	51	0.6302	137.4	60	0.5046	110.0	77	0.225	49.1
10am, 2pm	248.0	44	0.7244	179.7	55	0.5709	141.6	73	0.292	72.6
11am, 1pm	271.0	40	0.7644	207.2	54	0.5844	158.4	68	0.375	101.5
12 noon	280.0	40	0.7660	214.5	55	0.5736	160.6	65	0.423	118.4
Feb. or Oct.										
8am, 4pm	215.0	67	0.3981	85.6	73	0.2964	63.7	77	0.225	48.4
9am, 3pm	268.0	60	0.5024	134.6	70	0.3498	93.7	68	0.375	100.5
10am, 2pm	282.0	53	0.5963	168.2	66	0.4126	116.4	63	0.454	128.2
11am, 1pm	291.0	50	0.6464	188.1	64	0.4372	127.2	58	0.530	154.2
12 noon	296.7	50	0.6428	190.7	65	0.4226	125.4	55	0.574	170.0
Mar. or Sept.										
7am, 5pm	117.0	82	0.1316	15.4	86	0.0668	7.8	79	0.191	22.3
8am, 4pm	207.2	77	0.2242	46.5	84	0.1004	20.8	68	0.375	77.7
9am, 3pm	237.9	71	0.3297	78.4	81	0.1575	37.5	59	0.515	122.5

Continued on following page

South wall — TABLE 3c — Latitude 40°

Solar time	I_s	15° Slope forward: i	cos i	I_s cos i	30° Slope forward: i	cos i	I_s cos i	Horizontal: i	cos i	I_s cos i
December										
8am. 4pm	168.0	59	0.5205	87.4	65	0.4243	71.3	81	0.156	26.3
9am. 3pm	223.0	51	0.6340	141.4	60	0.5035	112.3	76	0.242	54.0
10am. 2pm	261.0	45	0.7056	184.2	57	0.5406	141.1	70	0.342	89.2
11am. 1pm	274.0	42	0.7476	204.8	56	0.5607	153.6	66	0.407	111.5
12 noon	276.8	40	0.7660	212.0	55	0.5736	158.8	65	0.423	117.0
Jan. or Nov.										
8am. 4pm	170.0	60	0.4931	83.8	66	0.4000	68.0	81	0.156	26.6
9am. 3pm	240.0	53	0.5966	143.2	63	0.4609	110.6	74	0.276	66.2
10am. 2pm	277.0	49	0.6511	180.4	62	0.4746	131.5	66	0.407	112.7
11am. 1pm	287.0	46	0.6942	199.2	60	0.4963	142.4	62	0.470	134.9
12 noon	288.0	44	0.7193	207.2	59	0.5150	148.3	61	0.485	139.7
Feb. or Oct.										*
8am. 4pm	232.0	68	0.3711	86.1	75	0.2632	61.1	75	0.259	60.0
9am. 3pm	274.0	62	0.4739	129.8	72	0.3155	86.4	66	0.407	111.5
10am. 2pm	291.0	58	0.5339	155.4	70	0.3366	98.0	58	0.530	154.1
11am. 1pm	298.0	55	0.5781	172.3	69	0.3568	106.3	53	0.602	179.5
12 noon	304.5	54	0.5878	179.0	69	0.3584	109.1	51	0.629	191.7
Mar. or Sept.										
7am. 5pm	133.5	86	0.0776	10.4	89	0.0139	1.9	78	0.208	27.8
8am. 4pm	215.6	79	0.1966	42.4	86	0.0671	14.5	66	0.407	87.8
9am. 3pm	247.0	73	0.2916	72.0	84	0.1113	27.5	56	0.559	138.1
10am. 2pm	264.5	69	0.3519	93.1	82	0.1360	36.0	48	0.669	177.0
11am. 1pm	274.6	67	0.3882	106.6	82	0.1455	40.0	41	0.755	207.4
12 noon	277.0	66	0.4067	112.7	81	0.1564	43.3	39	0.777	215.2
Apr. or Aug.										
8am. 4pm	237.9	89	0.0246	5.9	*	*	*	59	0.515	122.5
9am. 3pm	264.4	84	0.0958	25.3	*	*	*	48	0.669	177.0
10am. 2pm	278.9	81	0.1623	45.3	*	*	*	38	0.788	220.0
11am. 1pm	284.1	77	0.2175	61.8	*	*	*	31	0.857	243.5
12 noon	286.8	78	0.2079	59.6	*	*	*	27	0.891	255.7
May or July										
8am. 4pm	249.8	*	*	*	*	*	*	55	0.574	143.3
9am. 3pm	272.1	*	*	*	*	*	*	43	0.731	199.0
10am. 2pm	282.5	88	0.0380	10.7	*	*	*	33	0.839	237.0
11am. 1pm	288.3	86	0.0774	22.3	*	*	*	24	0.914	263.5
12 noon	290.2	85	0.0872	25.3	*	*	*	20	0.940	272.5
June										
8am. 4pm	256.7	†	†	†	†	†	†	52	0.616	158.0
9am. 3pm	275.8	*	*	*	*	*	*	40	0.766	211.2
10am. 2pm	285.5	*	*	*	*	*	*	29	0.875	250.0
11am. 1pm	289.8	89	0.0197	5.7	*	*	*	21	0.934	271.0
12 noon	290.8	89	0.0175	5.1	*	*	*	16	0.961	279.3

*At these times the solar altitude is too high to permit irradiation of the wall.
†At these times the position of the sun is north of east or west, hence the wall will not be irradiated.

South wall — TABLE 4c. continued — Latitude 45°

Solar time	I_s	15° Slope forward: i	cos i	I_s cos i	30° Slope forward: i	cos i	I_s cos i	Horizontal: i	cos i	I_s cos i
Mar or Sept. continued										
10am. 2pm	258.9	66	0.4123	106.7	78	0.2008	52.0	51	0.629	162.8
11am. 1pm	267.7	62	0.4733	126.7	76	0.2379	63.7	46	0.695	186.2
12 noon	270.6	61	0.4848	131.2	76	0.2419	65.5	44	0.719	194.8
Apr. or Aug.										
8am. 4pm	235.1	87	0.0588	13.8	*	*	*	60	0.500	117.5
9am. 3pm	260.4	80	0.1695	44.1	*	*	*	50	0.643	167.5
10am. 2pm	274.6	76	0.2369	65.1	89	0.0101	2.8	41	0.755	207.3
11am. 1pm	280.8	73	0.2860	80.3	88	0.0369	10.4	35	0.819	230.0
12 noon	283.5	73	0.2924	82.9	88	0.0349	9.9	32	0.848	240.5
May or July										
8am. 4pm	249.8	*	*	*	*	*	*	55	0.574	143.2
9am. 3pm	269.3	88	0.0394	10.6	*	*	*	45	0.707	190.7
10am. 2pm	280.8	84	0.1059	29.7	*	*	*	35	0.819	230.0
11am. 1pm	286.1	81	0.1603	45.9	*	*	*	28	0.883	252.5
12 noon	287.8	80	0.1737	50.0	*	*	*	25	0.906	261.0
June										
8am. 4pm	256.7	*	*	*	*	*	*	52	0.616	158.1
9am. 3pm	273.4	*	*	*	*	*	*	42	0.743	203.5
10am. 2pm	283.3	87	0.0518	14.7	*	*	*	32	0.848	240.3
11am. 1pm	287.8	84	0.1039	29.9	*	*	*	25	0.906	261.5
12 noon	289.9	84	0.1045	30.3	*	*	*	21	0.934	271.5

*At these times the solar altitude is too high to permit irradiation of the wall.

the law and your profits

JOHN F. MORRISSEY, author of this regular feature, is an attorney at law and has an extensive practical business and legal background. This series is based on actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

An "Appearance of Authority" May Bind Employer for His Agent's Acts

LEGAL PROBLEMS often occur where an employee or agent of a company, apparently on behalf of his employer, makes statements or does certain acts upon which a third party relies, only to have the employer deny that the agent ever had the authority to make the statement or do the act.

Since firms or principals generally act through individuals who are considered in law as "agents," most of us must assume that they have the authority to bind their employers when appearing to act in the employers' behalf.

When we purchase merchandise from a company, for instance, we have an understandable right to believe that the employee or agent handling the purchase contract is authorized to do so. Actually he may not have had the authority, so the employer might ask, "How can I be bound by an unauthorized act?"

Well generally the employer is *not* bound, unless (and this is a very broad exception) the employer has given the agent the "color" or appearance of authority and the third party has reasonable grounds for relying on what appears to be authority.

Let's consider the case of an attorney, acting in his usual capacity as an agent.

By written contract, the A. Settler Air Conditioning Co. agreed to install some air conditioning and ventilation equipment in a building owned by the Reneg Co., for the sum of $11 thousand.

Settler installed the air conditioning equipment, but failed to complete the contract by installing the specified exhaust system. Settler Co. claimed that its failure to install was due to a failure of the architect to locate vents on the building plans until after the walls were closed. Reneg refused to pay.

Subsequently, some negotiations were entered into by attorneys for both parties, and a tentative adjustment was agreed upon — but Reneg refused to go through with it.

Settler filed suit alleging that a contract of settlement had been entered into, whereby Reneg was to pay $9 thousand. Reneg denied that any settlement figure had been agreed upon.

During a discussion in court, Reneg's attorney, Mr. Smith, who had engaged in the settlement negotiations, stated that he had informed Settler's attorney that Reneg would pay $9 thousand in exchange for a release from Settler. He further stated that he had received the release, but that his client Reneg was unable to raise the $9 thousand.

The trial court entered judgment against Reneg for $9 thousand, and Reneg appealed.

There, Reneg's new attorneys argued that Mr. Smith had never obtained authority from Reneg to settle for the amount stated, nor did Reneg ever ratify such a settlement figure. They cited a general rule of law that the mere statements of Mr. Smith as an alleged agent were insufficient to establish his agency.

"Yes," said the higher court, "but the extent of his authority, if any, may be shown through the testimony of an agent. Mr. Smith made his statement in court and it has the same credence as sworn testimony.

"Reneg was present when Smith's statement was made and Reneg made no denial of its truth. Smith was representing Reneg in the trial court and there is a presumption that an attorney has authority to bind his clients by his actions relating to the conduct of a lawsuit.

"We think the trial court could properly find, as it did, that Mr. Smith had made a settlement agreement with the approval of Reneg, and that the settlement only fell through because Reneg could not raise the money."

It is not so much a question of whether an agent *has* specific authority, but whether authority is *presumed* on the basis of circumstances, appearance, custom, and legal implication. ≠

COAL

What every engineer should know

Coal is a vital fuel in our industry. To generate heat for many applications, millions of tons are produced and burned each year. How much do you know about it—its composition, classifications, heating values? What do rank and grade of coal indicate? Heating, Piping & Air Conditioning herein continues its question-and-answer series covering these and other facets of this all-important heat source.

By WILLIE HAMMER
Mechanical Engineer

Q. What are the disadvantages of using lignite as fuel?

A. Lignites have high moisture content necessitating proper conditions before they can be burned well. Loss of moisture, either through processing or through weathering, causes the lignite to disintegrate into fines. It is therefore not well suited to much handling or transportation over long distances. Installations using lignite are usually located close to the mining area.

Q. Which states have appreciable deposits of lignite?

A. North Dakota has about 600 billion tons, Montana about 80 billion tons, and Texas about 20 billion tons. Only about one-third of these amounts might be considered recoverable. North Dakota is the largest producer, with an output of about 3 million tons per year.

Q. With what type of firing equipment can lignite be used?

A. Lignites are free-burning and are usually fired on chain grate or travelling grate stokers, with spreader stokers, or in furnaces using pulverized coal.

Q. What is the calorific value of lignite?

A. As mined, it has a calorific value of 5500 to 8300 Btu per lb. In one plant, crushed lignite is dried to 5 percent moisture or less, raising the heat value per pound as fired to 10,800 Btu from 6800 Btu.

Q. What are the different groups in the sub-bituminous rank?

A. There are three groups according to the ASTM classification: sub-bituminous A, B and C. Sub-bituminous A has moist Btu content of 11,000 or more and less than 13,000, and is both weathering and non-agglomerating; sub-bituminous B has moist Btu of 9500 or more and less than 11,000; sub-bituminous C has moist Btu of 8300 or more and less than 9500.

Q. What is the availability of sub-bituminous coal?

A. Sub-bituminous coal constitutes about 25 percent of the coal reserves of the U.S. However, it is concentrated in the Northern Great Plains and Rocky Mountain provinces, with some in the Pacific Coast province. Almost none is found in the Eastern, Interior, or Gulf provinces.

Q. How do sub-bituminous coals differ from lignites?

A. Sub-bituminous coals were produced from lignites after being subjected to long periods of pressure and heat which reduced the amounts of volatile matter, oxygen, and moisture present and increased the proportion of fixed carbon. In color, sub-bituminous coals vary from brownish-black to black. In general, they appear smooth and lack the layers of the lignites, and are higher in heat content.

COAL —

what every engineer should know

Q. What are the approximate amounts of volatile matter, moisture, and fixed carbon in sub-bituminous coals?

A. Volatile matter, 30 to 45 percent; moisture, 10 to 30 percent; and fixed carbon, 35 to 60 percent.

Q. Is sub-bituminous coal free-burning or caking?

A. Sub-bituminous coals are free-burning. Like lignite, they break up into fines on drying, necessitating their use in plants near the areas in which they are mined. Like lignites, they are usually burned on chain or travelling grate stokers, with spreader stokers, or as pulverized coal.

Q. About what loss in heating value might be expected due to the weathering of sub-bituminous coal?

A. Approximately 2 to 3 percent for the first year and up to 5 percent for a three-year period.

Q. What happens when coal weathers?

A. In weathering, coal may slack or break up in size, lose heat content, and decrease its tendency to cake.

Q. What causes slacking or breakup of coal?

A. Coal loses moisture from its outer surfaces first and tends to contract on drying. Since the rates of drying and contraction are not uniform for both the surfaces and interiors of the pieces, cracking and splitting occur. Conversely, air dried coal which absorbs moisture will expand more rapidly at the surface than in its interior portions, causing further breakup of the pieces.

Q. Is there any way to avoid the effect of weathering on sub-bituminous coal?

A. It can be stored under water or in pits to avoid exposure to air. It should not be piled to heights greater than 10 ft. The pile should be compacted and sealed to reduce the passage of air.

Q. How many groups are there in the bituminous rank and what are their limits?

A. There are five groups in the bituminous rank, according to the ASTM classification: (1) *low volatile* — with dry fixed carbon, 78 percent or more and less than 86 percent (dry volatile matter, 22 percent or less and more than 14 percent); (2) *medium volatile* — with dry fixed carbon, 69 percent or more and less than 78 percent (dry volatile matter, 31 percent or less and more than 22 percent); (3) *high-volatile A* — with dry fixed carbon, less than 69 percent (dry volatile matter more than 31 percent) and moist Btu, 14,000 or more; (4) *high-volatile B* — moist Btu, 13,000 or more and less than 14,000; and (5) *high-volatile C* —moist Btu, 11,000 or more and less than 13,000. Coals which have fixed carbon of 69 percent or more on the dry, mineral-matterfree basis are classified according to the amount of fixed carbon, regardless of Btu.

Q. The limits for high-volatile C bituminous and for sub-bituminous A are both "Moist Btu, 11,000 or more and less than 13,000." Is there any difference between the two types of coal?

A. Coal within limits given will be classified as *sub-bituminous A* if it is both weathering and non-agglomerating. It will be classified as *high-volatile C* bituminous if it is agglomerating and nonweathering, or agglomerating and weathering, or non-agglomerating and nonweathering.

a question series on an

Q. What is the availability of bituminous coal?

A. Bituminous coal is the most abundant of the various ranks of coal and is found in all coal provinces of the U.S. Recoverable reserves are estimated at 525 billion tons, or about 56 percent of the total of all ranks. About 43 percent is located in the Eastern province, 37 percent in the Interior province, and the balance in the other provinces.

Q. Are there any major differences between the bituminous coals of the different areas?

A. Almost all the bituminous coal of the Eastern and Interior provinces is caking coal and some of it has properties which make it excellent for production of coke. Western bituminous coals are generally free-burning and not suitable for coke. Eastern, Arkansas, and Oklahoma coals are usually of higher heat content than those of the Midwest and Rocky Mountain areas.

Q. Which bituminous coals usually are caking?

A. Generally speaking, caking coals are in the low-

volatile, medium-volatile, and high-volatile *A* groups.

Q. What is meant by the term "semi-bituminous" coal?

A. Semi-bituminous was a classification in use before adoption of the ASTM's method of ranking coals. It is approximately equivalent to ASTM's low-volatile bituminous coal. Semi-bituminous coal therefore, in spite of the prefix, is about the same as the highest group of bituminous with the greatest heat content per lb and the least tendency to smoke.

Q. What is the effect to weathering on bituminous coals?

A. Some of the low-volatile grades break up into small irregular pieces, whereas high-volatile coals break up along cleavage planes into prisms. Loss of heating value depends on the amount of volatile matter present in the grade under consideration.

Q. How is bituminous coal classified according to size and use?

and answer important fuel

A. Sizing of bituminous coal is not completely standardized and varies considerably, but one of the systems in use is shown in the following series. It is usually advisable to indicate size desired when ordering, rather than to use the names. The larger size (when two are given in parentheses) is the diameter of the round holes of a sieve through which the piece will pass, and the smaller indicates the size hole through which it will not pass. These series are as follows: (1) *run of mine* (as it comes from the mine without screening) — used for steam production and for domestic heating in the mine area; (2) *lump* (5 in.) — for hand firing for industrial and domestic usage; (3) *egg* (5 × 2 in.) — for domestic use in hand fired furnaces, and for gas producers; (4) *nut* (2 × 1¼ in.) — for domestic use, gas producers, and small industrial stokers; (5) *stoker* (1¼ × ¾ in.) — for domestic and small industrial stokers; and (6) *slack* (¾ in. and smaller) — industrial use.

Q. With what types of fuel burning equipment can bituminous coal be used?

A. In general, applications are as follows (though other types can be used): underfeed stokers — caking coals for gravity feed, free-burning coals for horizontal feed; spreader stokers — all grades; chain grate or travelling grate stokers — free burning; pulverized coal and cyclone burners — high and medium-volatile coals are preferred, but low volatile coals can be used if more finely pulverized.

Q. Can caking bituminous coal be treated to permit its use on chain grate or travelling grate stokers?

A. Caking coals can be used if moisture content is kept between 14 and 18 percent even if moisture must be added (tempering), by selecting grades with only small amounts of fines, and by using the coal after it has had a chance to weather.

Q. What effect does the addition of moisture have in this case?

A. The addition of moisture in tempering wets the fines, causing their adherence to other coal surfaces, and keeps them from clogging the air passages. It has a tendency to make the coal more free-burning by increasing the uniformity and porosity of the fuel bed. Also, it reduces the rate at which the volatiles distill.

Q. Into what groups is anthracite coal classified?

A. In the ASTM classification, there are three groups of anthracite rank: (1) *meta-anthracite* — with dry fixed carbon, 98 percent or more (dry volatile matter, 2 percent or less); (2) *anthracite* — with dry fixed carbon, 92 percent or more and less than 98 percent (dry volatile matter, 8 percent or less and more than 2 percent); (3) *semi-anthracite* — with dry fixed carbon, 86 percent or more and less than 92 percent (dry volatile matter, 14 percent or less and more than 8 percent) and non-agglomerating.

Q. What is the availability and distribution of anthracite in the U.S.?

A. It is estimated that the recoverable reserves of anthracite coal in the U.S. are 15 billion tons of which 98 percent is in Pennsylvania. Other states with anthracite deposits are Virginia, Arkansas, Colorado, New Mexico, and Washington. Anthracite of all three groups in total comprises about 0.5 percent of the total coal reserves of the U.S. Deposits of meta-anthracite are few and small, with fields in Pennsylvania, Rhode Island, and Massachusetts.

Q. Is meta-anthracite a premium fuel because of its high fixed carbon content?

A. No. Meta-anthractite is hard to ignite and

COAL —
what every engineer should know

burn. It has high mineral-matter content and comparatively low heat content as found in the Rhode Island and Massachusetts deposits. Because of its low bed moisture content, it picks up moisture rapidly on exposure. The coal, as mined, is extremely variable in quality. It breaks easily into fines, requiring special storage and handling equipment, and almost constant attendance during its use for satisfactory results.

Q. What are the approximate heat contents of anthracite and semi-anthracite?

A. Anthracite has approximately 14,700 Btu per lb (moist, mineral-matterfree basis) and semi-anthracite has heat content as high as 15,200 Btu per lb. On an average as-received basis, anthracite has about 13,000 Btu per lb and semi-anthracite about 12,000.

Q. What are slow-burning, medium-burning, and free-burning anthracites?

A. Anthracites have different ignition temperatures and rates of burning, and although the differences are not very great, the terms *slow-burning, medium-burning,* and *free-burning* have come into use. Usually, slow-burning will be low volatile anthracite; free-burning, high volatile; and medium-burning, in between.

Q. With what types of firing equipment can anthracite be burned?

A. Anthracite is generally used with all types of domestic equipment, spreader, chain grate and travelling grate stokers, and with pulverized coal burners.

Q. In what sizes is anthracite usually specified?

A. The State of Pennsylvania officially designates seven sizes of anthracite, whereas the industry has 10 sizes of which the top six are the same as the State's. The first number indicates the size of the round hole in inches through which the pieces will pass, and the second indicates the size on which it will be retained. *Broken,* 4-3/8 to 3¼ — 3 in.; *egg,* 3¼ — 3 to 2-7/16 in; *stove,* 2-7/16 to 1-5/8; *nut,* 1-5/8 to 13/16; *pea,* 13/16 to 9/16; *buckwheat,* 9/16 to 5/16; *rice,* 5/16 to 3/16; *barley,* 3/16 to 3/32; *No.* 4, 3/32 to 3/64; and *No.* 5, 3/64 in. and smaller.

Q. With what type of equipment is each size generally used?

A. Broken, egg, stove, and *nut* are used in hand fired domestic furnaces; *buckwheat* is used for domestic stoker fired furnaces or hand fired steam boilers; *barley* and *No.* 4 are used on chain grate or travelling grate stokers; and *No.* 4 and *No.* 5 are used with pulverized coal burners.

Q. How do the prices of these sizes generally compare?

A. Egg, stove, and *nut* are about the same and highest priced; *broken* is almost the same, but generally a few cents cheaper; starting with *pea,* prices decrease with the size of the coal. *Barley* is less than half the price of egg, stove or nut.

Q. What are some of the differences between anthracite and bituminous coal?

A. Anthracite is "hard" coal, more resistant to abrasion, grinding and to breaking up into fines; it is cleaner to handle; it is lower in volatile matter, and is nonsmoking; has lower sulfur and oxygen content; it is higher in fixed carbon; it is harder to ignite; it is not subject to spontaneous combustion; it is noncaking; has little odor; has no loss in heat content due to weathering; has high heat content (but usually less than that of low volatile bituminous coal); on the average, has higher ash fusion temperature (2700 to 2920 F).

Q. Has the production of anthracite coal been increasing or decreasing?

A. The production of anthracite coal for domestic fuel purposes has been decreasing because of the increased use of automatic gas and oil fired equipment. However, anthracite is being used for other special purposes. Because of its generally higher cost, it usually cannot compete with other coal on an economic basis for fuel. (Average price for anthracite at the mine is slightly over $8 per ton compared with $5 for bituminous.) Its greatest market has been where a smokeless fuel is required.

Q. For what other purposes is anthracite being used?

A. Anthracite is being used in the production of cement; ore reduction and sintering; chemical processes; as a filter medium; in the manufacture of graphite and carbon products, such as refractories, acid-resisting tanks, electrodes, and brushes; surfacing material for roads; and in briquets and packaged fuel. ≠

More Q and A on coal will be presented in an early issue.

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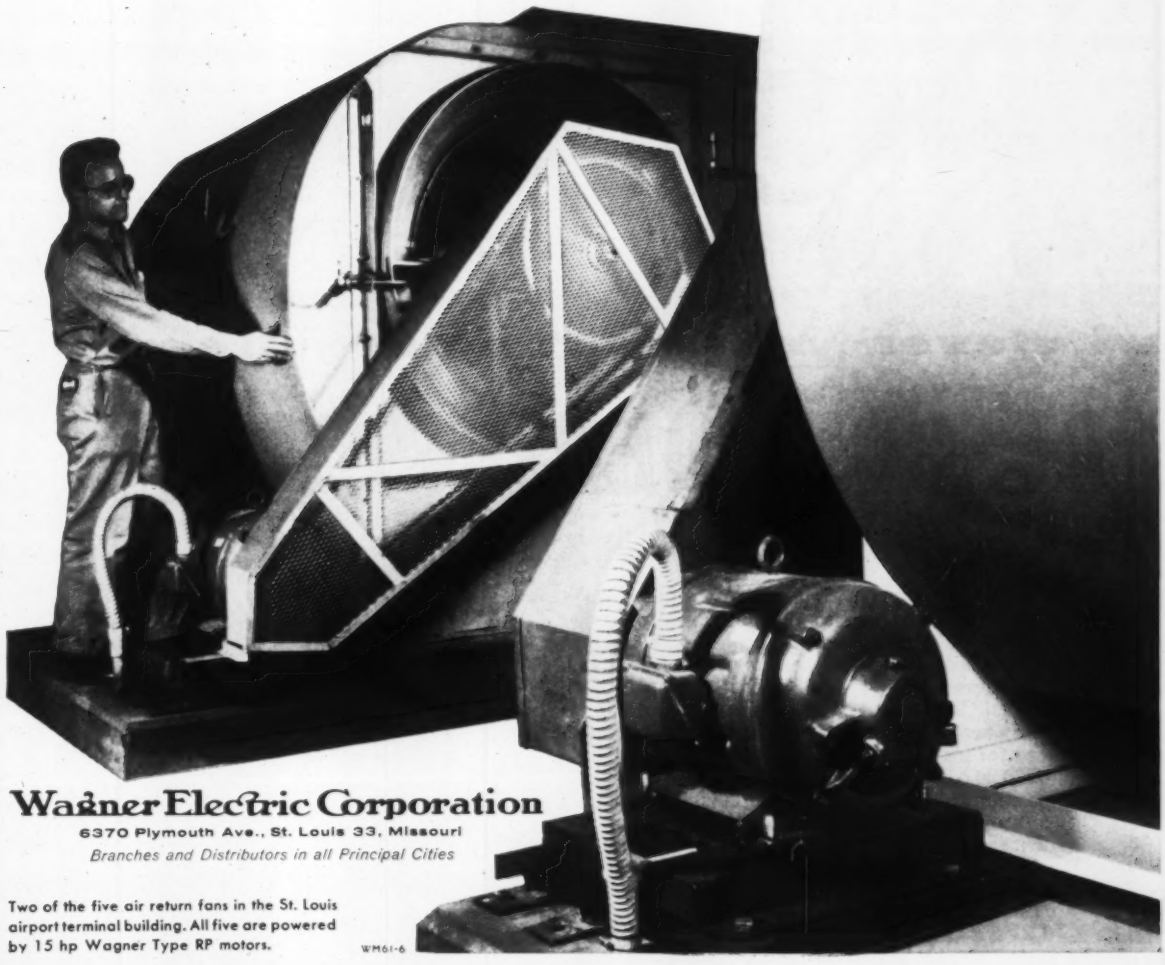

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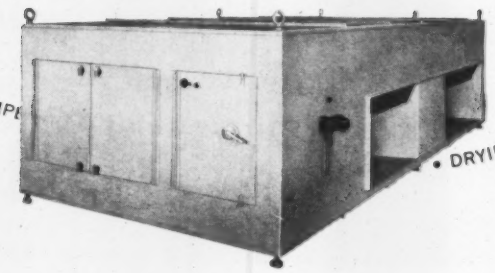

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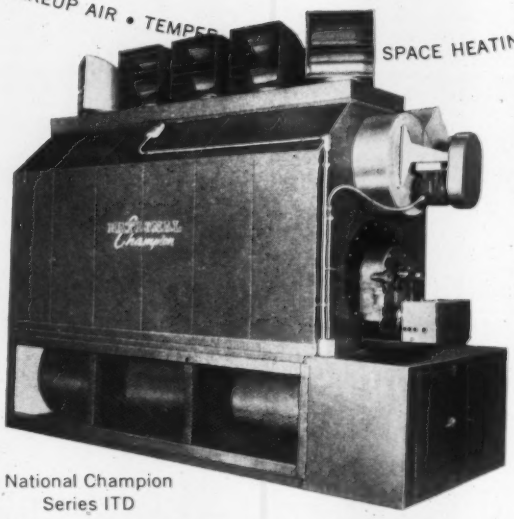

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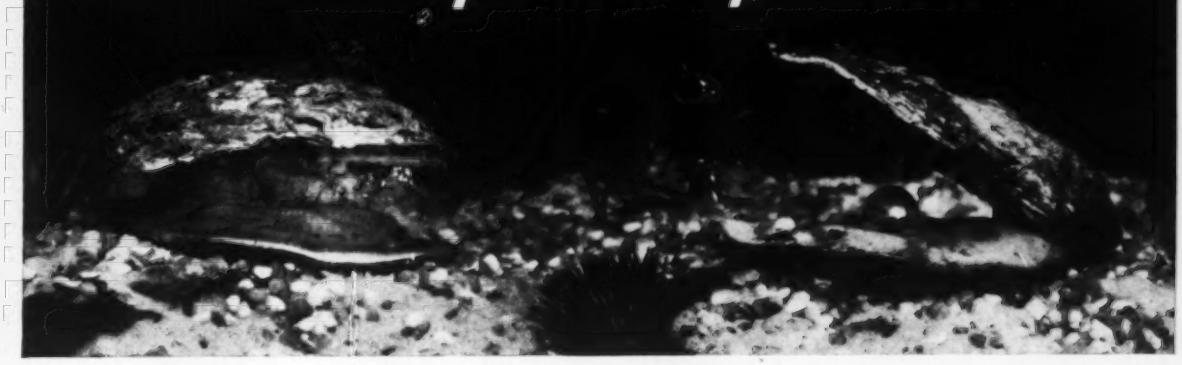

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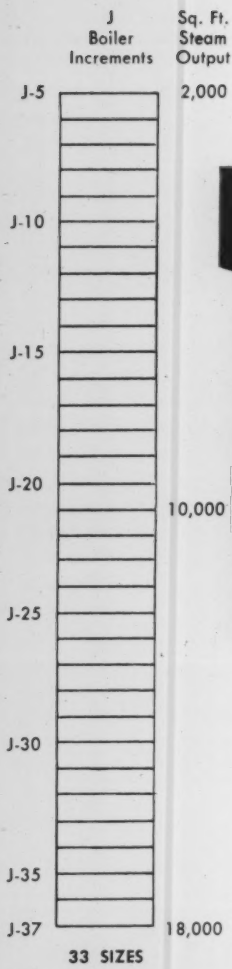

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Close sizing is only one of many features offered by Type "J" Boilers. Others include:

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3. A.G.A. approved efficiency of 80%... approved for all gases.
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7. No refractories, no motors or fans, no tube replacement, no water treatment.
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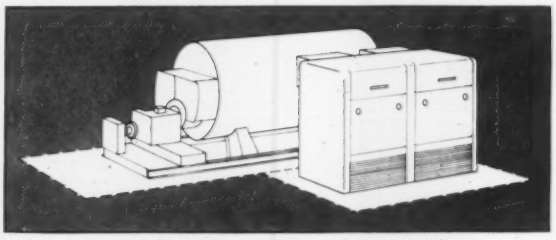
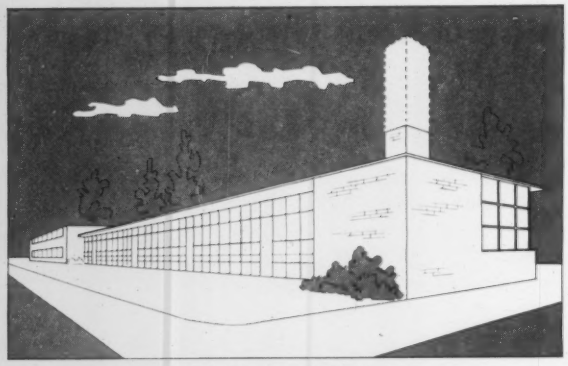
9. All surfaces easily accessible for cleaning.



SAVES SPACE

Sketch shows the space saved by a 60 H.P. Type "J" Boiler over a typical scotch marine boiler of comparable rating. It is approximately one half as long, one foot less in height and only a few inches greater in depth, including space necessary for the draft hood. The required service area is smaller... and appreciably smaller if tube replacement is to be made through the rear door of the scotch marine boiler.



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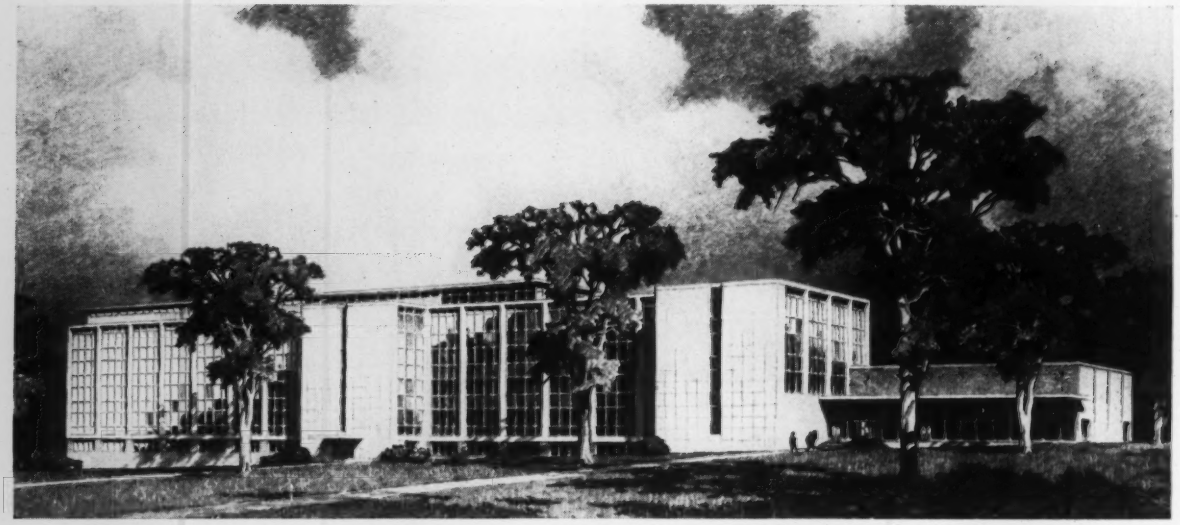
In the new
Science Center
at Western Reserve University...



John Schoff Millis Science Center on the Western Reserve Campus, Adelbert Road, Cleveland, Ohio. Architects: *Small, Smith, Reeb, & Draz.* General Contractor: *The Albert M. Higley Company.* Mechanical Contractor: *Gorman-Lavelle Plumbing & Heating Company.*

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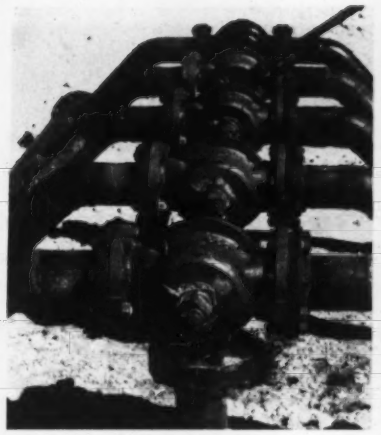

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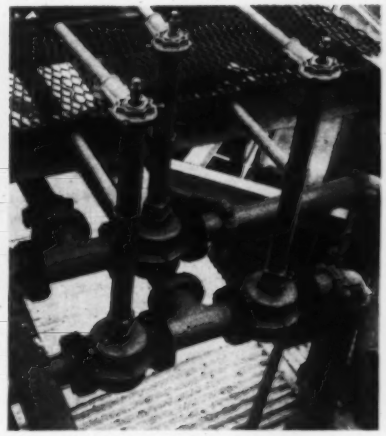
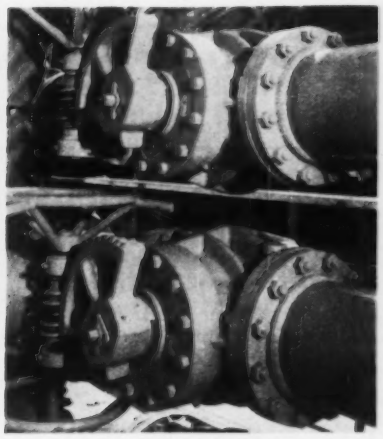


Uranium Processing



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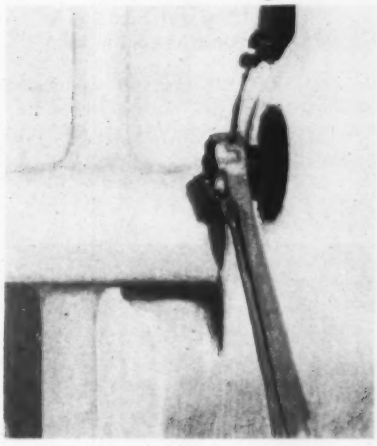

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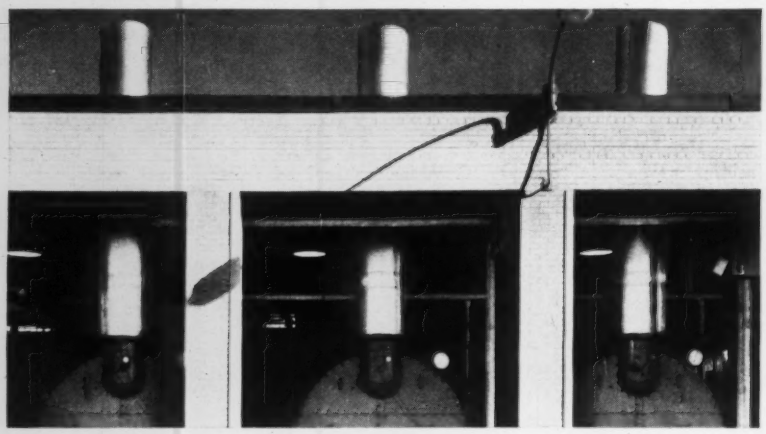
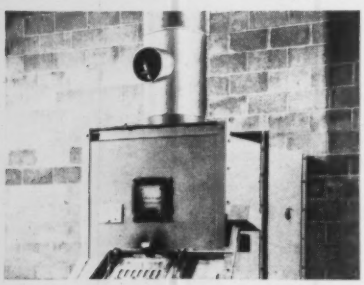


Three Van-Packer 30-inch I.D. Model BF Industrial Stacks on these boilers provide highly efficient, low-cost installation at this Chicago-area high school. Refractory construction of these stacks provides high draft for efficient operation of the equipment. Stack cost is about the same as steel stacks for the same application, yet the non-corroding refractory of the Van-Packer provides an average stack life three times greater than steel stacks. An aluminized steel jacket which encases each 3-foot stack section requires no painting.



A Van-Packer Model HT Industrial Stack serves incinerators with flue gas temperatures to 1800°F — or 2000°F for brief periods of forced firing.

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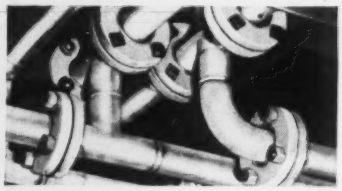


The ultimate installed cost of corrosion-resistant process lines *can* be substantially reduced . . . where pipe line design specifications take full advantage of up-to-date developments in improved fittings design and new piping standards.

The most recent issue of the Code for Pressure Piping, ASA B31.3-1959, allows use of *light wall* Stainless Steel Schedules 5 and 10 pipe and fittings for critical process lines to a degree not possible with *outdated* specifications. The broader scope of pressure-temperature operating conditions included in this new code, permits computations utilizing these more economical wall thicknesses. This, plus a specification recognizing the efficiency of Speedline fittings, guarantees a soundly designed system at a *lower* installed cost.

Every Speedline fitting has built-in advantages that contribute to lower installation cost because they are designed especially for use with light wall Schedules 5 and 10 pipe. Speedline's extra length feature means butt joints are easier to align and easier to weld because you're always connecting "straight to straight". There's ample clearance to attach flanges to any or all ends of a Speedline fitting without fouling—by expanding or welding. Speedline aligning connectors assure sound socket-joining for both pipe and fittings. With Speedline—*one fitting* does it all. Review your process piping specifications to be sure they call for all of the cost savings possible with light wall pipe and modern Speedline fittings.

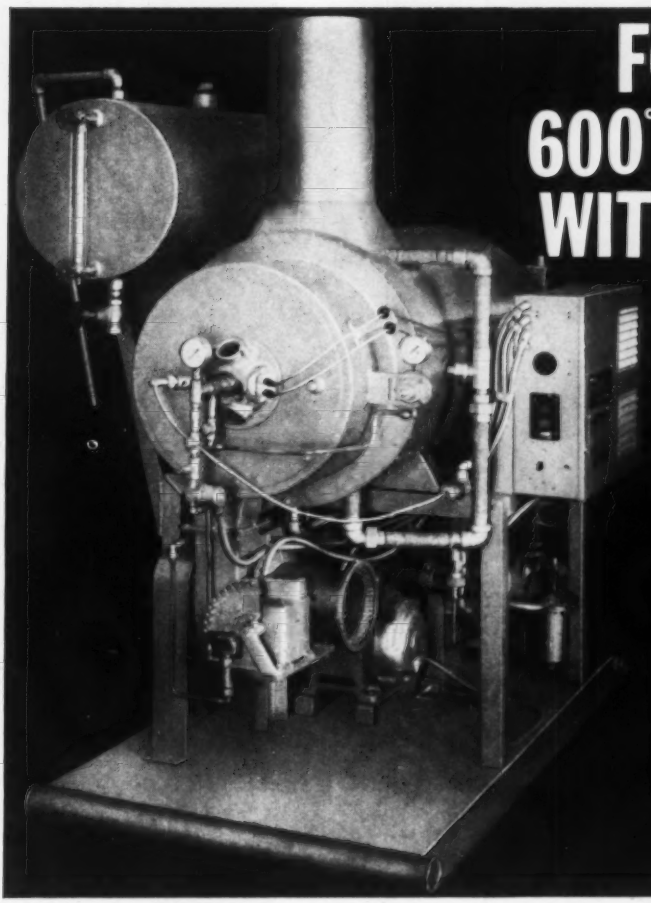
Speedline®

CORROSION-RESISTANT FITTINGS

STAINLESS STEEL • ALUMINUM • SPECIAL ALLOYS

100C

A PRODUCT OF **HORACE T. POTTS COMPANY** • 576 E. ERIE AVENUE, PHILADELPHIA 34, PA



FOR 600° TEMPERATURES WITHOUT ANY PRESSURE!

VAPOR MODULĀTIC

HI·R·TEMP

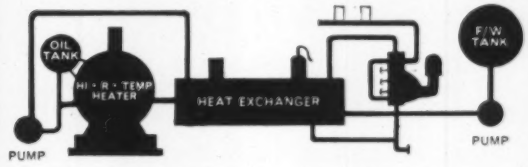
LIQUID PHASE HEATER

This Vapor Modulâtic HI·R·TEMP Liquid Phase Heater uses heat transfer aids to provide dependable, automatic, accurately controlled heat transfer to 600° F., without high pressures. Burns natural gas, propane, butane, No. 2 diesel oil, or kerosene. Sizes to 13,000,000 b.t.u.

Check these advantages:

- ACCURATE TEMPERATURE CONTROL. Modulâting controls automatically maintain pre-determined temperature of heat transfer oil.
- NO WATER TREATMENT NEEDED. Eliminates cost of treatment system. No corrosion, scale, freezing problems.
- POSITIVE OIL FLOW. Rotary gear pump assures uniform circulation...prevents hot-spots, coking, sludging, oil breakdown.
- LOW INSTALLATION COST. Completely unitized, skid-mounted with all piping in place. Factory tested before shipment. Compact, lightweight...install it anywhere.
- LOW-PRESSURE VESSELS AND FLOW CIRCUITS. Saves the cost of heavy-duty piping, fittings, valves.
- COLD OIL SEAL. Expansion tank is uninsulated and isolated from main flow of hot transfer oil. Protects oil against atmosphere, sludging, deterioration.
- OPTIMUM SAFETY. Non-toxic. Built to ASME codes. Flame failure, low oil level, high temperature safety shut-off controls are standard. CO_2 quenching ring optional.
- LOW OPERATING COST. Forced-draft combustion, coiled tube design is highly efficient. No high pressures, does not require licensed engineer to operate.

here's how one vapor Hi·R·Temp, with heat exchangers, can supply your needs for processing, heating, hot water, etc.



Heated oil from HI·R·TEMP (at temperatures to 600° F.) passes through heat exchangers to provide steam for processing; at 450° for steam for heating plant and office; at 200° for hot water for cleaning, washing, other uses. Provides full, economical use of heat to lower your operating costs!

VAPOR

For complete information, send coupon today.

Vapor Heating Corporation, Dept. 21-D
80 East Jackson Boulevard, Chicago 4

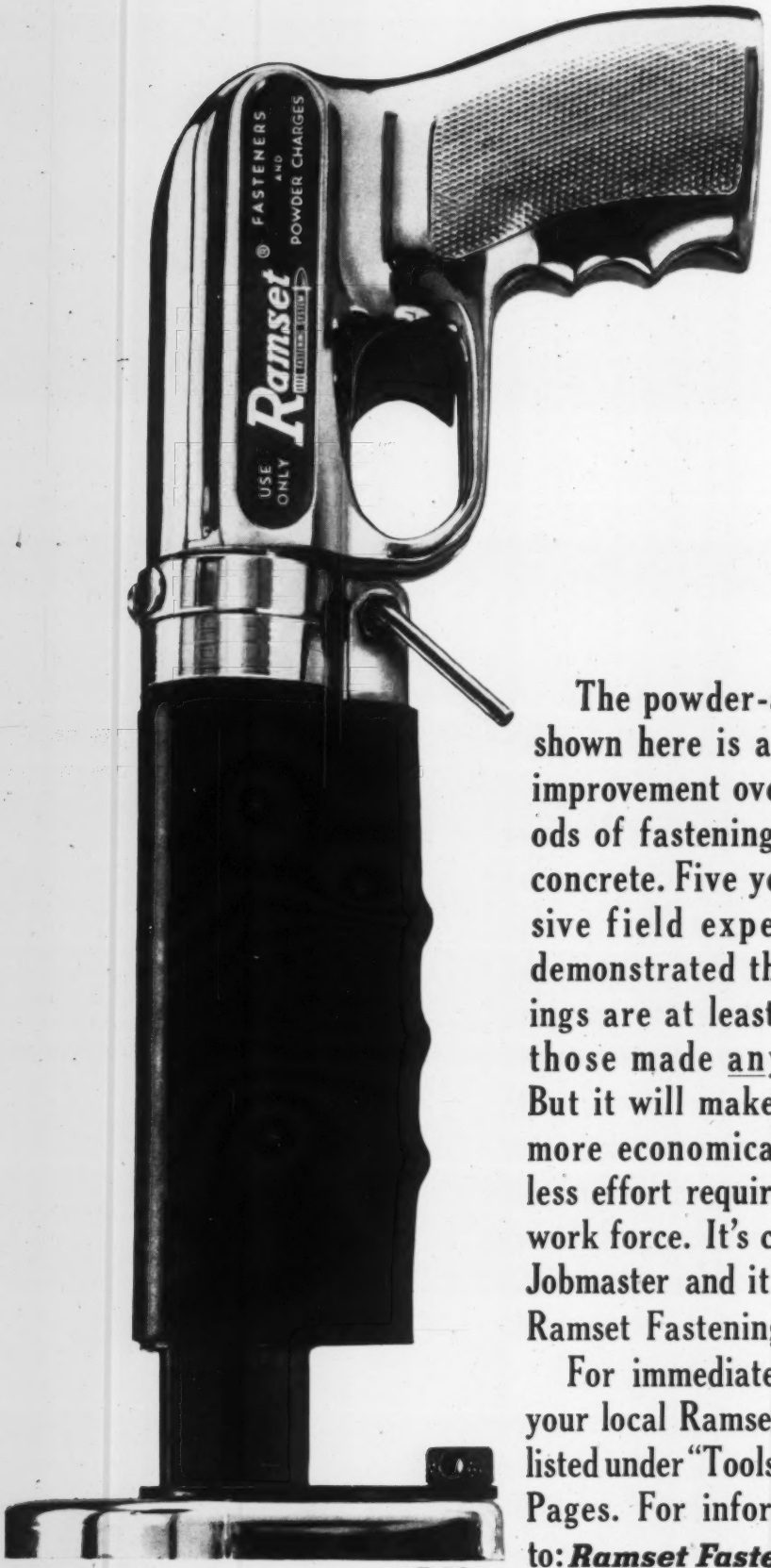
Please send me Bulletin 4023 on your HI·R·TEMP Liquid Phase Heater.

Name_____

Company_____

Address_____

City, Zone, State_____

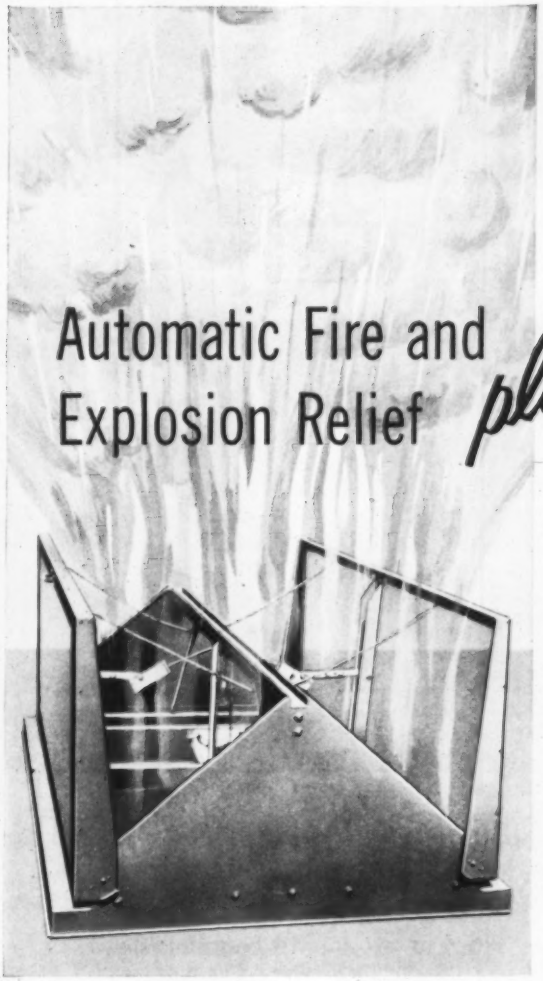


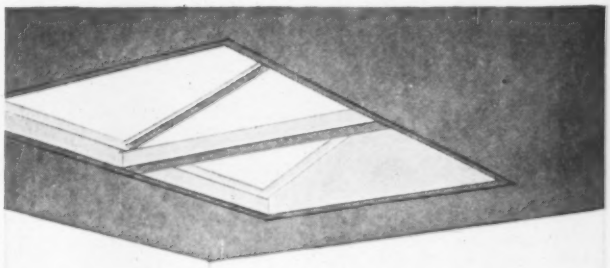
The powder-actuated tool shown here is a fundamental improvement over other methods of fastening to steel and concrete. Five years of extensive field experience have demonstrated that its fastenings are at least the equal of those made any other way. But it will make them faster, more economically, and with less effort required from your work force. It's called the Duo-Jobmaster and it's part of the Ramset Fastening System.

For immediate service, call your local Ramset dealer. He's listed under "Tools" in the Yellow Pages. For information write to: ***Ramset Fastening System***

WINCHESTER-WESTERN DIVISION Olin 291-D Winchester Ave., New Haven 4, Conn.

New Swartwout
SKY-LITE PYROJECTOR





Automatic Fire and Explosion Relief *plus* Skylighting... With The Same Unit!

In case of fire or explosion, Sky-Lite Pyrojector opens automatically . . . vents heat, smoke, shock waves upward through the roof . . . lets fire-fighters reach the source of the fire before it spreads. Heavy-duty mechanism is triggered automatically by parting of Underwriters approved fusible link.

Savings gained in insurance rates indicate that Swartwout Pyrojectors pay for themselves.

Plenty of light . . . soft, diffused and natural . . . streams in through the big translucent fiberglass panels. As an extra safety feature, Sky-Lite Pyrojector provides natural light in case of power failures.

Each damper panel is made of two tough, weatherproof fiberglass sheets with 1" insulating air space between.

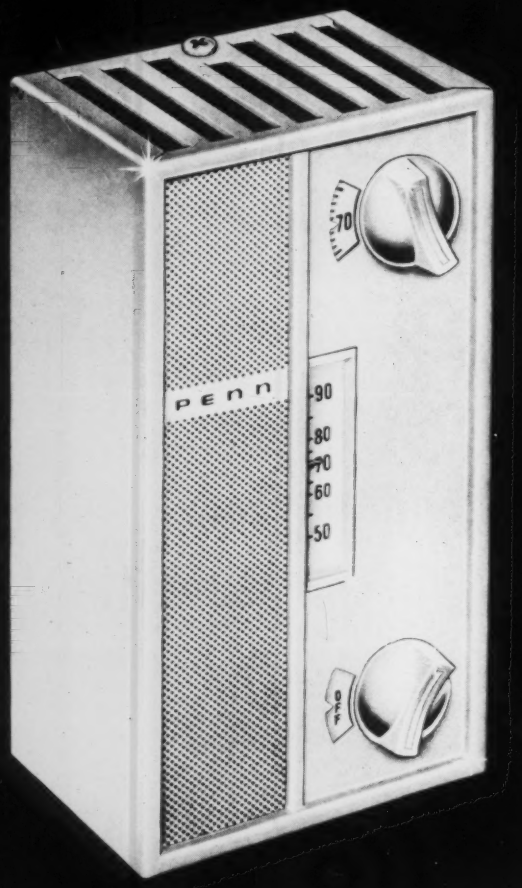
Get emergency relief plus skylighting with only *one* unit, *one* installation, *one* cost . . . get Swartwout Sky-Lite Pyrojector. Send for free folder now.

Swartwout

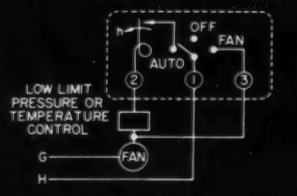
SWARTWOUT Fabricators, Inc.

Kokomo, Indiana

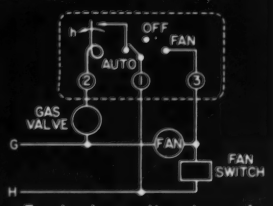
In Canada: Rosco Metal Products, Ltd., 850 DuPont Street, Toronto, Canada



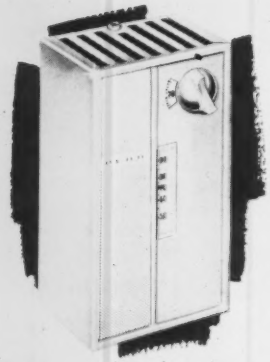
NEW UNIT HEATER THERMOSTAT



Typical application of Type 822A7 with AUTO-OFF-FAN selector on steam or hot water coil unit.



Typical application of Type 822A7 with AUTO-OFF-FAN selector on gas-fired unit heater.



Series 822, with or without function selector knob, rated for ¼ hp. service. Series 824, without function selector, is rated for 1 hp. service.

features easy-to-use, locking-type knobs for heating and summer ventilation

Here's the modern line-voltage thermostat with beautiful "slim-line" styling. Its built-in AUTO-OFF-FAN selector assures year 'round efficiency of unit heaters . . . saves fuel in winter . . . provides ventilation in summer.

It has easy-to-read temperature and function selector dials. It has exclusive, locking-type adjusting knobs, attached to cover but connected to adjusting shafts by factory-installed "keys" within the knobs. It has a built-in, concealed adjustable high limit stop for temperature dial. It has low operating differential at all voltages and amperages within its rating. It has easiest field wiring ever . . . simply connect to large terminals *on back of thermostat*. And, it has many more features you'll want. Learn more about this better thermostat for unit heaters . . . write to the Penn factory.

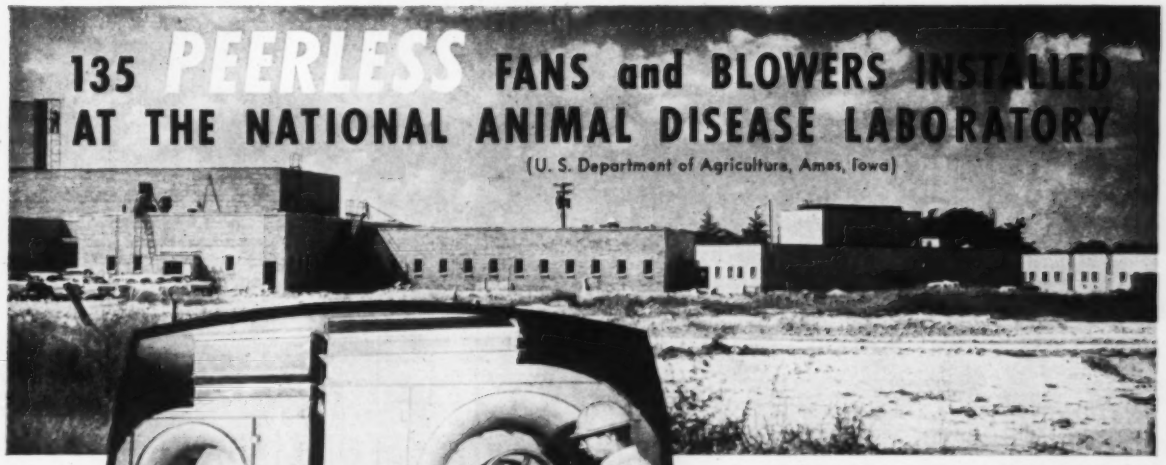
PENN CONTROLS, INC. Goshen, Indiana

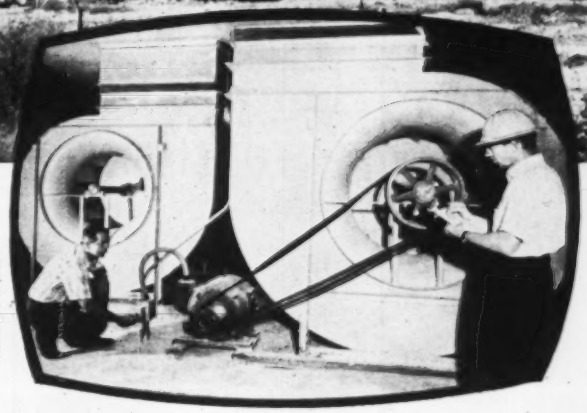
EXPORT DIVISION: 27 E. 38th ST., NEW YORK, N.Y.

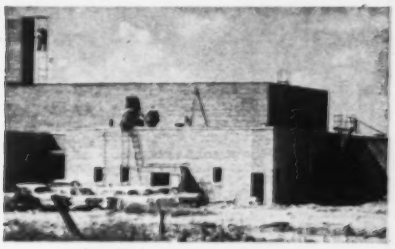
AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

135 PEERLESS FANS and BLOWERS INSTALLED AT THE NATIONAL ANIMAL DISEASE LABORATORY

(U. S. Department of Agriculture, Ames, Iowa)







BUILDING NO. 2 — 30 FANS

BUILDING NO. 3 — 49 FANS

OTHER BUILDINGS — 56 FANS

ASSURE TROUBLE-FREE DEPENDABLE SERVICE

A constant supply of fresh air and an equal amount of exhaust air are of critical importance at this 14-million-dollar installation. Lack of proper ventilation would seriously undermine the success of any experiment being conducted here. For every group of supply and exhaust fans and blowers, there is stand-by equipment of identical capacity. Blowers and duct work are welded "bacteria-tight" to prevent any contamination from one research section to another. The entire installation is capable of delivering 1,042,375 cfm at capacity operation.

Peerless Fans and Blowers are recognized for their long, consistent and trouble-free service year after year. Write today for additional information.

ARCHITECTS AND ENGINEERS: Ralph M. Parsons Co., Los Angeles, California
Brooks-Borg, Des Moines, Iowa

GENERAL CONTRACTOR: Beck-Truckee Co., Dallas, Texas

MECHANICAL CONTRACTOR: Iowa Sheet Metal Contractors, Inc., Des Moines, Iowa

A COMPLETE LINE OF AIR-MOVING EQUIPMENT

PEERLESS ELECTRIC DIVISION
W. MARKET ST.

PORTER

H. K. PORTER COMPANY, INC.
WARREN, O.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

A NEW ADVANCE IN REDUCING FIRE HAZARDS

Now Available – A Permanent Non-Combustible Vapor Barrier

For Use as Facing for Insulation, Pipe Jacketing, Duct Lining

The non-combustible properties of this vapor barrier, called PYRO-KURE, will not migrate or leach out.

It is the only vapor barrier on the market that offers this permanent, fire retarding property!

It is the first and only vapor barrier with an unqualified U/L flame spread rating!

Here is an important contribution toward the concept of "total fireproofness" that architects, contractors and building management are demanding today.

Pyro-Kure is a "sandwich" of various combinations of foil, paper or plastic film. It can also be reinforced to supply amazing additional strength that gives it extra long life and makes it easy to apply.

As a line of vapor barrier facing they have a perm rating of 0.1, or less, and are attractive in appearance.

Pyro-Kure is self-extinguishing when its combustion temperature is reached. It is the *only* vapor barrier with an unqualified Underwriters' Laboratories Flame Spread Rating. Its ratings are: 25 for the kraft side; 5 for the foil side.

You will want to know more about this development, perhaps for a current project. Write to our main offices in Attleboro, Mass. for a complete file of data, facts, figures and samples.

reinforced paper, foil, plastics and other products for construction, industrial packaging and agriculture

American **SISALKRAFT** Company

DIVISION OF ST. REGIS PAPER COMPANY

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In Canada: Murray-Brantford Ltd., in principal cities

series A 22", 25", 30"

Built-in flexibility makes the Lau Series A the number one choice for commercial and industrial installations. With a C.F.M. range of 8,000 to 35,000, this efficient unit may be used in many different sizes and types of air conditioning systems. For even greater performance and flexibility this blower may be operated in banks of two or three. The Series A features a heavy gauge riveted wheel, large reservoir oil type bearings and provision for either top or rear mounting motor.

For specific information on the 22", 25" and 30" Series A or for help with any air handling problem write Wm. H. Wessling, Director of Engineering.

INDOOR COMFORT

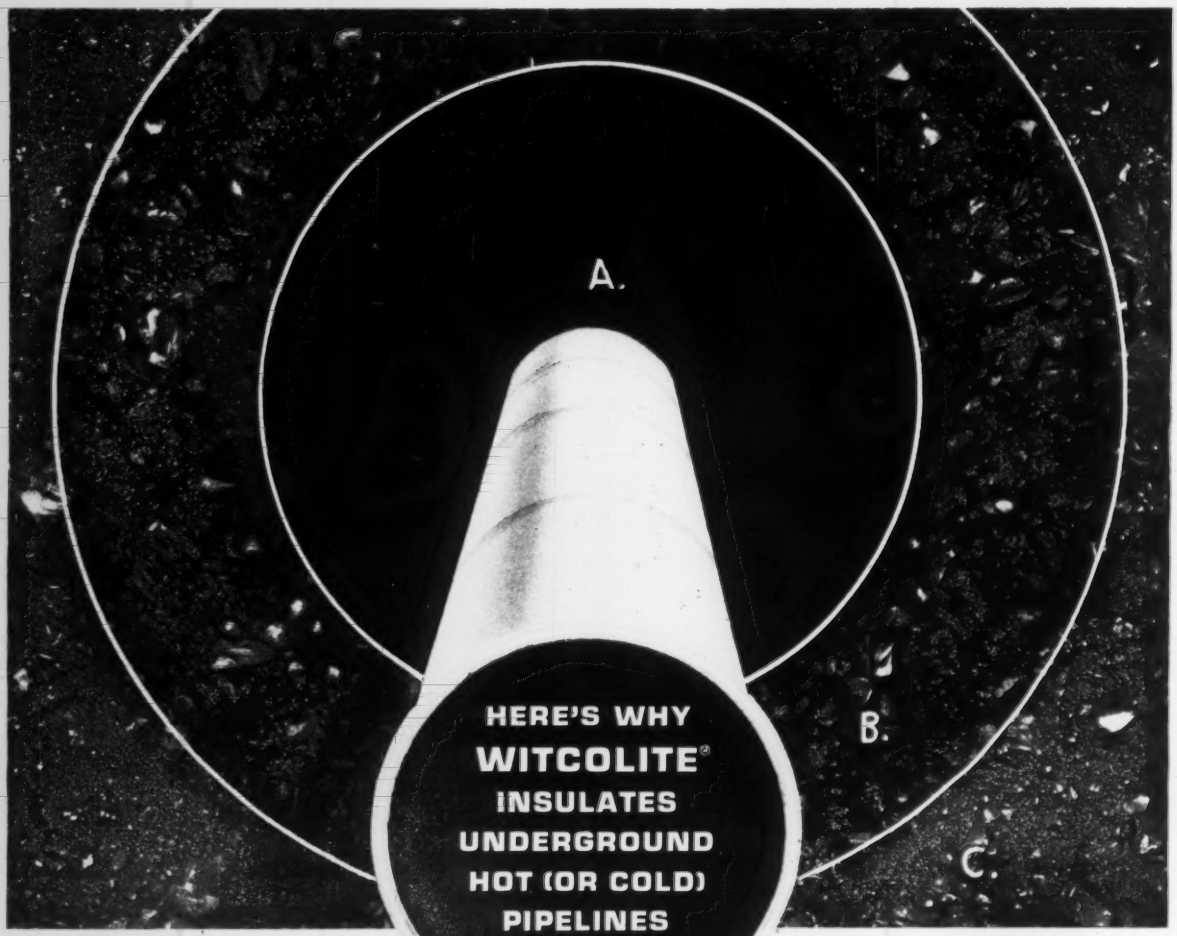
THE LAU BLOWER COMPANY

2027 HOME AVENUE
DAYTON 7, OHIO

PLANTS IN DAYTON, O. · IRWINDALE, CALIF. · CLEVELAND, O. · INDIANAPOLIS, IND. · KITCHENER, ONT.

LAU — WORLD'S LEADING MANUFACTURERS OF AIR MOVING EQUIPMENT

Ratings shown are based on tests and rated in accordance with the recommended procedure of the A.M.A.

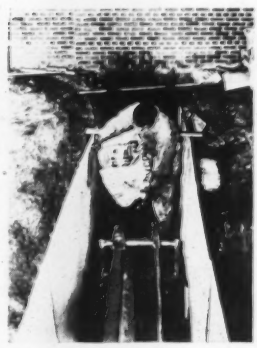


Diagrammatic cross section of pipeline insulated with Witcolite.®

Witcolite is a granulated, resilient adhesive material which is easily installed. After curing, three zones of insulation are formed:
A) **cured zone**—insulating and anticorrosive area locked around pipe. B) **sintered zone**—air-pocketed insulating area...moisture barrier. C) **granular zone**—loose particles providing maximum thermal insulation.

WITCOLITE OFFERS ALL THESE ADVANTAGES

3 LABORATORY-CONTROLLED GRADES of granulated particle size assure perfect high thermal insulation of underground hot pipes...even with pipes alternately conveying hot and cold liquids. **HIGH THERMAL INSULATION** is the result of Witcolite's three zone protection. The product resists physical breakdown and adheres resiliently to pipes as they expand and contract with temperature changes. **HIGH CORROSION RESISTANCE** protects pipes permanently against acids and alkalis found underground. Witcolite is also effective against electrolytic processes. **HIGH WATER RESISTANCE,** results from the surface tension differential between water and Witcolite. No wetting of the underlying surface occurs. **LOWEST COST** of any quality material on an installed basis is an extra plus with Witcolite.
For further information or technical literature on Witcolite, simply write or call the nearest Witco office listed below for your local representative's address.



Witcolite is delivered to your job site in convenient, easily handled 50 pound multi-wall paper bags.

WITCO CHEMICAL COMPANY, Inc.
PIONEER PRODUCTS DIVISION
Dept. 81-01, 122 East 42nd Street, New York 17, N.Y.

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EQUIPMENT DEVELOPMENTS

Packaged Make-Up Air Units For Roof Installation

Vertical units have 20,000 to 60,000 cfm with 1,875,000 to 6,000,000 Btu per hr capacities, fired by gas. Air intake through louvers mounted at top of unit. Filter banks and platform to service filters optional. Automatic controls mounted inside housing, entered through a walk-in door. Automatic shut-down dampers standard. Remote control station available. — *Metals Engineering & Manufacturing Co., Inc., 8824 Lyndon, Detroit 38.*

Boiler Features Burner Mounted on Side

Burner mounted on side of unit rated at 6, 12, 15, 20, and 30 hp. Fired by gas, oil, or gas-oil. Unit of horizontal design. Operates from 201,000 to 1,005,000 Btu per hr output at 100 or 125 lb wp standard; pressures available to 500 lb wp. Boiler shell insulated with glass fiber and covered with a steel jacket. Shell completely welded, X-rayed, stress-relieved, and mounted on structural steel skids. Units built to ASME code standards. Bulletin sent on request. — *Eclipse Fuel Engineering Co., 1139 Buchanan St., Rockford, Ill.*

Central Air Conditioner Has Air-Cooled Condenser

Units in 30 to 60 ton capacities have integral air-cooled condensers. Dual circuit semi-hermetic compressors operate individually or together. Unit features horizontally split evaporator coil. Optional built-in modulating head pressure control available for low outside air conditions. Unit can be furnished in two sections for remote location of condenser. Bulletin 94A-1 sent on request. — *U. S. Air Conditioning Corp., P.O. Box 360, Delaware, O.*

Interception Filter Has Pleated Glass Mat Media

Disposable unit for room recirculators, kitchen range hoods, electronic cabinet cooling, and similar applications. NBS dust spot average efficiency 80 to 95 percent, depending on media used. Average filter life from 1200 to 10,000 hr. — *Cambridge Filter Products Corp., 738 Erie Blvd. East, Syracuse 1, N.Y.*

A-C Induction Motors Feature "Capsular" Insulation System

Encapsulated random wound a-c motors protect against moisture, chemicals, oils, and abrasive contaminants. Stators feature heat-resistant, plastic-resin that seal end coils and fills spaces between wires in stator slots. Available in open, drip-proof enclosures, 445U frame sizes and smaller, 600 v and below. Bulletin No. 3750 sent on request. — *Louis Allis Co., Dept. P., 427 E. Stewart St., Milwaukee 1.*

INFORMATION on capacities, dimensions, applications, and special features in each EQUIPMENT DEVELOPMENT item is presented in accordance with material furnished by the manufacturers, who may be contacted directly for more details.

Other Departments . . .

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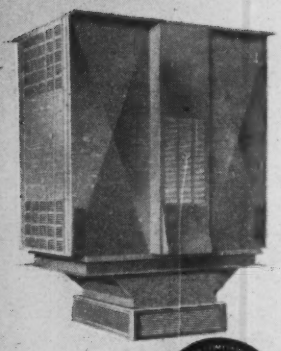
- New Books and Reports 228



New LENNOX Roof Top Unit

. . . a new concept in zoned heating, ventilating and air conditioning . . .

Now, out of sight, out of mind, out of high cost rental area! This new Lennox Roof Top Unit sits quietly on the roof, overseeing the comfort conditions required by your business. Consisting of two Lennox Landmark (modular heating and cooling) units, it is handsomely cased and expertly designed into one flexible package. It's available in 7½ and 10 tons of cooling, controlled by one heating/cooling thermostat; or it can be split into two zones, each controlled by a separate heating/cooling thermostat. Gas heating capacities range from 204,000 (in increments of 34,000) up to 340,000 Btuh. Automatically controlled outside air (up to 100%) is available for ventilation and "free" cooling.

"WRAP AROUND" FILTER BANK
. . . easy to change, low replacement cost—sized for low velocity, long life.

LARGE CAPACITY BLOWER
. . . moves air at low sound levels—vertical design of unit means air is turned only 180°—horizontal units must turn air 360°.

WEATHER-PROOF CABINET
. . . made of galvanized steel with acrylic finish for long, rust-free life. Pleasingly neutral, dawn-grey color.

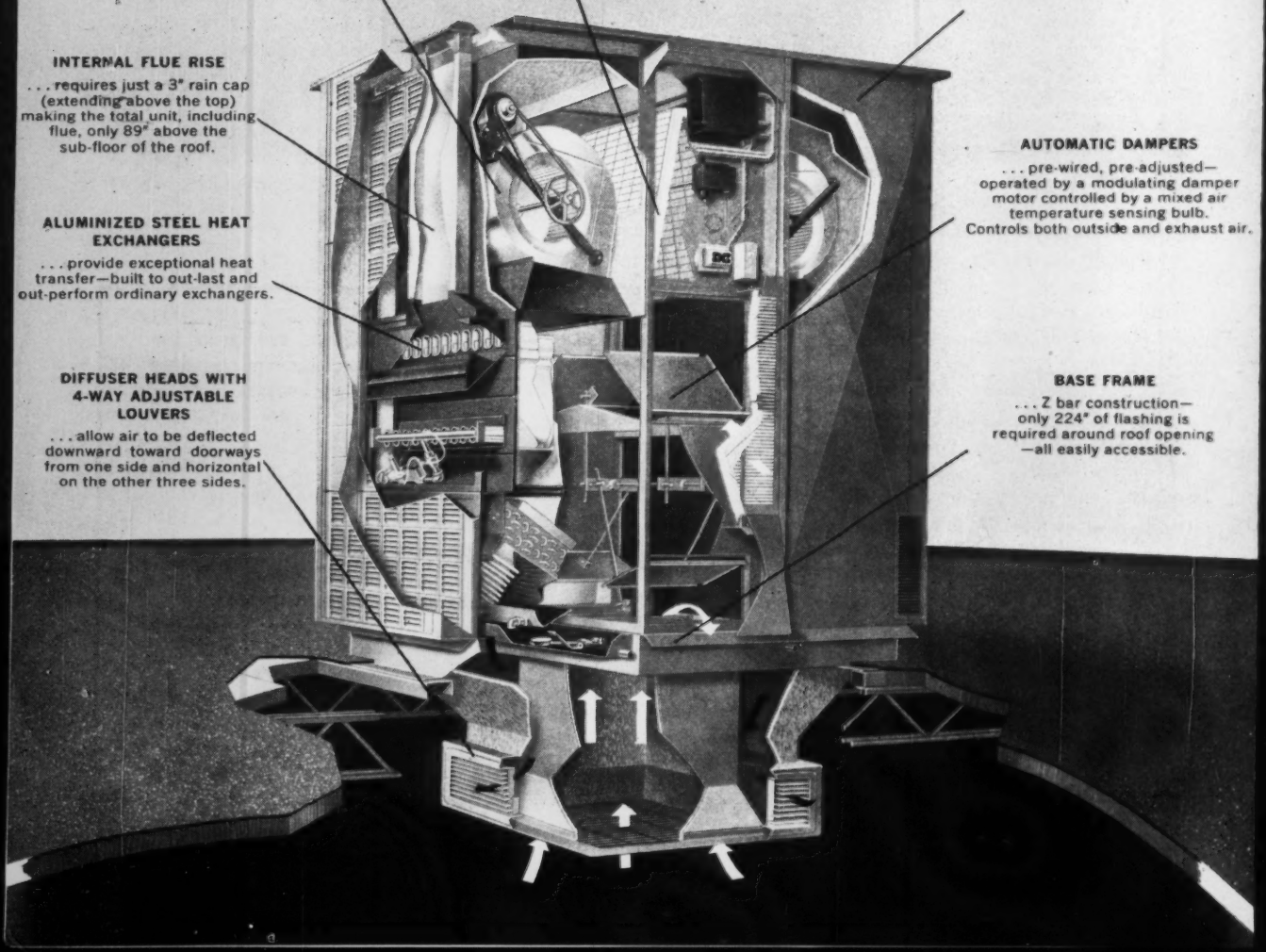
INTERNAL FLUE RISE
. . . requires just a 3" rain cap (extending above the top) making the total unit, including flue, only 89" above the sub-floor of the roof.

AUTOMATIC DAMPERS
. . . pre-wired, pre-adjusted—operated by a modulating damper motor controlled by a mixed air temperature sensing bulb. Controls both outside and exhaust air.

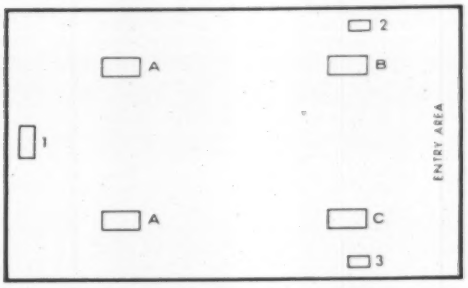
ALUMINIZED STEEL HEAT EXCHANGERS
. . . provide exceptional heat transfer—built to out-last and out-perform ordinary exchangers.

DIFFUSER HEADS WITH 4-WAY ADJUSTABLE LOUVERS
. . . allow air to be deflected downward toward doorways from one side and horizontal on the other three sides.

BASE FRAME
. . . Z bar construction—only 224" of flashing is required around roof opening—all easily accessible.

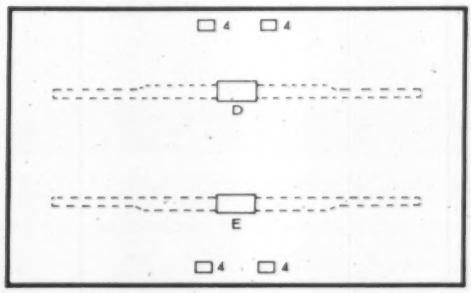


completely automatic—including outside and exhaust air control



Unmatched installation flexibility for large open areas

Units "A" are for rear zone of building. Each has two cooling and heating sections . . . a total of 408,000 Btuh heating and 18 tons of cooling. Condensing unit (1) serves both "A" units. Unit "B" has one 170,000 Btuh heat section discharging toward door (which can be thermostatically controlled for entryway heating), and one 136,000 Btuh section discharging away from door, with combination heating-cooling thermostat. Condensing unit (2) serves both cooling sections. Unit "C" has two 136,000 Btuh heating sections, and two cooling sections with a total of 7½ tons cooling, served by condensing unit (3).



Ideal for partitioned office areas

Here the Lennox Roof Top Units are connected to ducts. Unit "D" serves two zones with 136,000 and 102,000 Btuh heating, with 5 tons of cooling each. Unit "E" serves two zones with 136,000 and 170,000 Btuh heating, with 4 and 5 tons cooling. Units marked (4) are the individual air cooled condensing units.

WRITE FOR COMPLETE DATA, OFFERED FREE IN DETAILED "ROOF TOP UNIT" KIT. ADDRESS: LENNOX INDUSTRIES INC., 540 S. 12TH AVENUE, MARSHALLTOWN, IOWA.

Don't be satisfied with less than

LENNOX

HEATS • COOLS • TREATS AND MOVES AIR

LENNOX INDUSTRIES INC., FOUNDED 1895 — MARSHALLTOWN AND DES MOINES, IOWA; COLUMBUS, OHIO; SYRACUSE, NEW YORK; DECATUR, GEORGIA; FT. WORTH, TEXAS; SALT LAKE CITY, UTAH; LOS ANGELES, CALIFORNIA. LENNOX INDUSTRIES (CANADA) LTD.—TORONTO, MONTREAL, CALGARY, VANCOUVER, WINNIPEG.

EQUIPMENT DEVELOPMENTS

Continued

600 Hp Gas Turbine for Air Conditioning Power Source

Engine for operating pump and compressor drives, generators, and as a power source for air conditioning systems now under development. Unit is a completely axial flow regenerative machine with a six-stage compressor, dual rotary regenerators, a single-can combustor, a single-stage gas producer turbine and a single-stage power turbine. It will operate at a compressor pressure ratio of 3.8 and have a rotative speed of 21,500 rpm. — *Solar Aircraft Co., 2200 Pacific Highway, San Diego 12, Calif.*

Non-Clog Submersible Pumps Available in 2, 3, 4 In. Sizes

Pumps for handling large solids and stringy materials such as industrial wastes, light sludge, and slurries. Available in 2, 3, and 4 in. sizes. Have one-piece cast iron impeller in either two-blade or bladeless design. Totally enclosed non-ventilated motor has available range ¾ to 7½ hp; oil-filled interior and finned exterior for cooling. One-piece motor and pump shaft of 316 stainless steel. — *Fairbanks, Morse & Co., 600 N. Michigan Ave., Chicago 5.*

Motor Actuators for Floating, Proportional, or Two-Position Application

Units for positioning air dampers, control valves, programming devices, burner fuel valves, and similar equipment. Dust tight and splash proof units powered by split phase capacitor type motor that drives output shaft through hobbed reduction gears. Cam operated limit switches stop actuator movement at predetermined travel limits. Drive motor and gear train completely sealed in oil to provide permanent lubrication and cooling. Operates on 24 v a-c, 50/60 cycles. Bulletin 3230 sent on request. — *Penn Controls, Inc., Goshen, Ind.*

Butterfly Valves Rated At 150 Psi Water Pressure

Valves available for pipe size range from 2 to 18 in. Nickel-plated cast iron or cast steel bodies with stainless steel trim; other materials available. Units require no lubrication. Feature "O" ring seals. In lever operation, units open or close in a quarter turn. Gear operation optional in large sizes. Available as an integral unit in diameters up to 6 in; valves in all sizes are separate elements with interchangeable bolt-on flanges for screw, weld, flange, or groove installations. — *Lunkenheimer Co., P.O. Box 360, Annex Station, Cincinnati 14.*

Either Way

ALL SIGNS POINT TO MARLEY

DriCooler®

AIR COOLED CONDENSERS

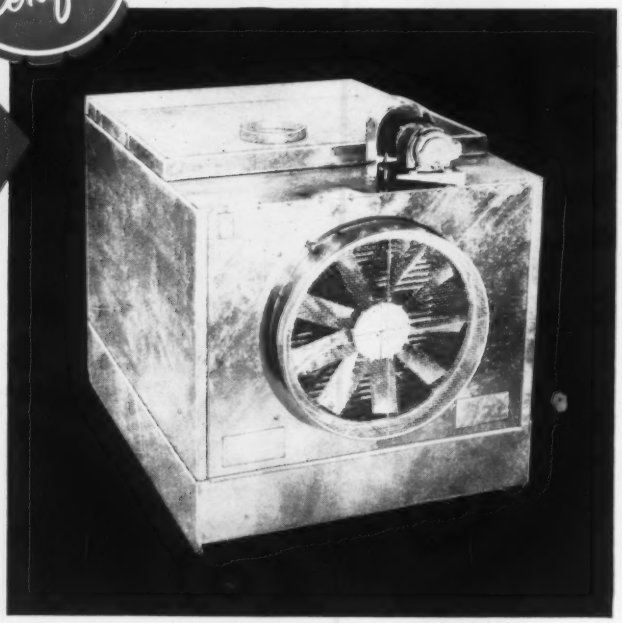
DriCoolers are engineered for ABILITY. Vertical blow-through design with diagonally positioned coils delivers greatest cooling *capability*. Rugged, galvanized structure and heavy duty air-moving equipment assures *durability*. Single or multi-circuit service in any location, regardless of prevailing winds, means complete *adaptability*. And the Marley Winter-Control Damper system provides simple, successful operation for one or a dozen circuits during low dry bulb periods—complete *controllability*.

Customer Certified

Aquatower®

WATER COOLING TOWERS

Aquatowers deliver more cooling capacity, more job satisfaction to contractors and owners—the results of Marley engineering and experience in more than 100,000 successful installations. That's why they have most efficient air-water balance; most lifetime, nailless filling; heavy-duty mechanical equipment — all contained in a rugged steel casing *protected by hot-dip galvanizing after fabrication.*



Marley

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Customer Certified

COOLING TOWERS AND DRICOOLERS

Every contractor is eligible to join this owner-education program and be selected to receive an all-expense-paid vacation for two. Get complete information at once from your Marley Man or mail the coupon below.

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Company_____

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EQUIPMENT DEVELOPMENTS

Continued

Roof Top Unit Heats, Ventilates, Air Conditions

Roof top unit combines two of firm's "Landmark" units in one package. Delivers either 7½ or 10 tons cooling with heating capacity from 204,000 (in increments of 34,000 Btu per hr) up to 340,000 Btu per hr. Controlled by single heating-cooling thermostat or by two thermostats with each controlling a separate zone. Conditioned air may be ducted or distributed through a diffusing head that projects below the ceiling surface. Combination duct and diffuser delivery also available. Replaceable or washable permanent filter has filter area of 13.7 sq ft. — *Lennox Industries Inc., Marshalltown, Ia.*

Fuel Oil Controller Available In Packaged Assembly

Unit combines all piping, gages, regulators, and valves used on firm's boiler fuel oil control systems. One unit suitable for heavy oil, another for light oil. Casing serves as a heat equalizer, permitting heavy oil to flow smoothly and reducing start-up time. — *Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee 12.*

Bronze Gate Valve For 125 Psi Service

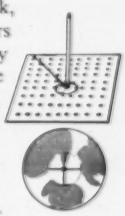
Full bodied valve has full opening at full flow. Tested for 125 psi service. Model "300" has "O" ring packing. Available in ½, ¾, 1, 1¼, 1½, and 2 in. sizes. Bulletin 103 sent on request. — *American Valve Manufacturing Co., Inc., 22 Bayview Ave., Manhasset, L.I., N.Y.*

SAVE TIME— SAVE MONEY with these dependable INSULATION HANGERS

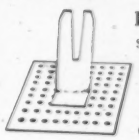
SEE OUR CATALOG IN SWEET'S OR WRITE FOR COPY

GEMCO Spindle Hangers and W-A Self-Locking Washers

Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed... with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.



GEMCO Pronged Hangers



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1 3/16" to 6 7/8") bend over to hold insulation firmly in place.

TUFF-WELD Nylon Hangers

Two-piece hangers... with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and Improved General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 28, ILLINOIS

DO YOU KNOW WHY FAIRBANKS VALVES

ARE BEING SPECIFIED AND INSTALLED IN THE NATION'S NEWEST MOST MODERN BUILDINGS?

THE PITTSBURGH HILTON
PITTSBURGH, PA.

OWNER:
Hilton Hotels Corporation, New York, N. Y.

ARCHITECT:
William B. Tabler, New York, N. Y.

CONSULTING MECHANICAL ENGINEER:
Jaros, Baum & Bolles, New York, N. Y.

GENERAL CONTRACTOR:
Turner Construction Co., New York, N. Y.

PLUMBING CONTRACTOR:
Sauer, Incorporated, Pittsburgh, Pa.

- Because Fairbanks Valves are Quality — DEPENDABLE — products.
- Because, over the past 67 years, long-lasting, trouble-free service has proven the DEPENDABILITY of Fairbanks Valves to the nation's leading consulting engineers, architects and contractors who have specified and installed these valves in the systems for which they were responsible. This acceptance of Fairbanks Valves is demonstrated by the fact that in over 50% of the new building construction described in an ENGINEERING NEWS-RECORD article "Office Building Boom Alters New York City Skyline", January 17, 1957, Fairbanks Valves were specified and installed.
- Because Fairbanks offers a full line of Bronze and Iron Body Valves for heating, piping and air conditioning systems.
- Because Fairbanks Valves are available the country over through stock carrying distributors in all the principal cities.

Do you have a copy of Fairbanks current Valve Catalog and Valve Comparison Chart? It will be a pleasure to send a copy of each to you.

THE Fairbanks COMPANY

EXECUTIVE OFFICE: 393 LAFAYETTE STREET, NEW YORK 3, NEW YORK

VALVES • DART UNIONS • CASTERS • TRUCKS • WHEELS

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520 Atlantic Avenue Boston 10, Mass. | 2600 So. Throop St. Chicago 8, Ill. | 393 Lafayette Street New York 3, N. Y. | 15 Stanwix Street Pittsburgh 22, Pa. | 202 Division Street Rome, Ga.

Plants: Binghamton, N. Y. • Rome, Ga.

EQUIPMENT DEVELOPMENTS

Continued

Cast Iron Boiler Rated to 6,120,000 Btu Per Hr Input

"Series 170" gas-fired cast iron boiler rated 680,000 to 6,120,000 Btu per hr input for hot water and steam heating systems. Fired with natural, manufactured, mixed, and LP gases. Unit has passed IBR, AGA, and ASME tests and requirements. Features high offset tube design; cast iron drilled port type burner; and removable end doors for access to flue ways. Available in deluxe or flush type design. Specifications, ratings, dimensional drawings, and information sent on request. — *The Peerless Heater Co., Boyertown, Pa.*

Electric Unit Ventilator For Schools

Units installed along window walls, either individually or with draft barrier storage cabinets. Air capacities 600 to 1500 cfm. Fans direct driven by three-speed motors. One-piece filters have disposable, renewable, or permanent media. Unit casing of 16 gage furniture steel with baked-on coral tan enamel and aluminum trim. Length varies with cfm and kw desired; all units 13¼ in. deep × 26 in. high. — *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8.*

Removable Enclosures for Under Window Air Diffusion Units

Units available in furniture steel, wood veneer, stainless steel, and other custom finishes. Panels completely flush, with no screws, locks, or handles visible. — *Buensod-Stacey Corp., 45 W. 18th St., New York 11.*

Here are the steam traps designed especially for heating systems . . .

ARMSTRONG OPEN FLOAT AND THERMOSTATIC STEAM TRAPS

Engineered for low pressure intermittent service where large amounts of air accumulate while steam is off

Armstrong O.F.&T. Traps make it possible for heating systems to deliver the efficiency they were designed to deliver. They are ideal for low pressure unit heaters, preheat and reheat coils, converters, hot water generators, etc.

Advantages to the user:

BIG AIR HANDLING CAPACITY—Thermic vent handles large amounts of air in system when steam is turned on. Fixed vent handles normal air in system.

NO STEAM LOSS—Stainless steel valve is water sealed, is not damaged by dirt or scale, cannot develop steam leaks.

CONDENSATE AND AIR REMOVED AT STEAM TEMPERATURE—No opening lag.

LONG LIFE—All working parts, including open float, are stainless steel. Bodies and caps designed for 250 psig operation. Open float cannot collapse.

MINIMUM MAINTENANCE—Simple, proved design and high quality materials assure trouble-free service.

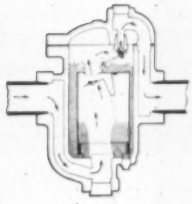
LOW COST—Mass production methods permit high quality at low cost.

EASY INSTALLATION—Horizontal straight-through pipe connections, conventional sizes.

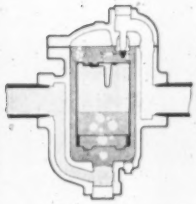
UNCONDITIONALLY GUARANTEED—All Armstrong Traps are guaranteed to satisfy the user or purchase price will be refunded.

908-STCOR

HOW ARMSTRONG O. F. & T. TRAPS WORK:



When steam is turned on, it pushes air through the wide open thermic vent and trap discharge valve at full differential pressure between supply and return lines. Condensate formed by incoming steam goes right through.



As steam reaches open float, thermostatic vent closes. Float fills with steam and rises to close trap valve. Residual air and CO_2 escape through fixed vent at steam temperature.

BULLETIN NO. 775 BULLETIN NO. 801

Use the coupon at right to get these helpful bulletins: No. 775 describes O.F.&T. traps fully. No. 801 tells how to select traps for draining unit heaters including data on 30 makes of unit heaters.

ARMSTRONG MACHINE WORKS

8745 **Maple St. • Three Rivers, Mich.**

Armstrong Machine Works

8745 Maple St., Three Rivers, Mich.

Please send me: ☐ O.F.&T. Trap Bulletin No. 775; ☐ Unit Heater Bulletin No. 801.

Name.....

Company.....

Address.....

City..... Zone..... State.....

"from Chicago"

immersi-pump

Trademark

SUBMERSIBLE NON-CLOG SEWAGE AND SUMP PUMP

- Pumps Sewage and other Liquids Containing Solids up to 2½"
- Operates with pump and motor completely submerged

Positively water proof—motor is totally enclosed and oil filled.

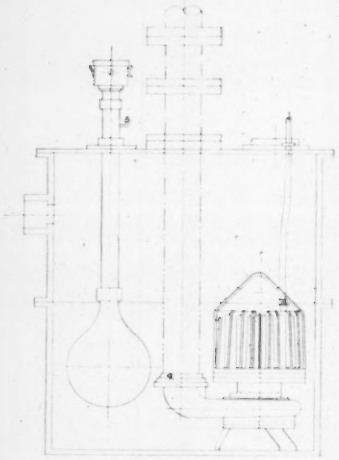
Check these SEVEN important features

1. Low original cost
2. Low maintenance cost
3. Easy to install
4. Easy to service
5. No superstructures required
6. Minimum headroom needed
7. Makes more floor space available

PLUS

Exclusive SEALTRODE Sealed Electrode Floatless Pump Controller . . . the only controller featuring completely sealed Electrodes . . . positively preventing insulation or coating by grease or other corrosive elements.

Ask for Bulletins Nos. 97 and 128-A.



Typical installation—single unit—duplex installation available

"Chicago" Distributors are located in most principal cities. See the one nearest you today for full details.

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION

CHICAGO PUMP

622C DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

EQUIPMENT DEVELOPMENTS

Continued

Fan-Coil Units Available With Full Line of Accessories

Units in 16 models have 3 to 92 ton capacities with 880 to 47,500 cfm. Accessories include: cleanable or throw-away filters for high or low velocity; face and bypass dampers; mixing boxes, with or without dampers; variable pitch sheaves; choice of aluminum or copper fins and fin spacing, with six, seven, eight, or 10 fins per in.; spray or steam grid humidifiers; and vibration isolators. Units may be used with chilled water or hot water coils, steam coils, or direct expansion coils. — *Halstead & Mitchell Co., Bessemer Bldg., Pittsburgh 22.*

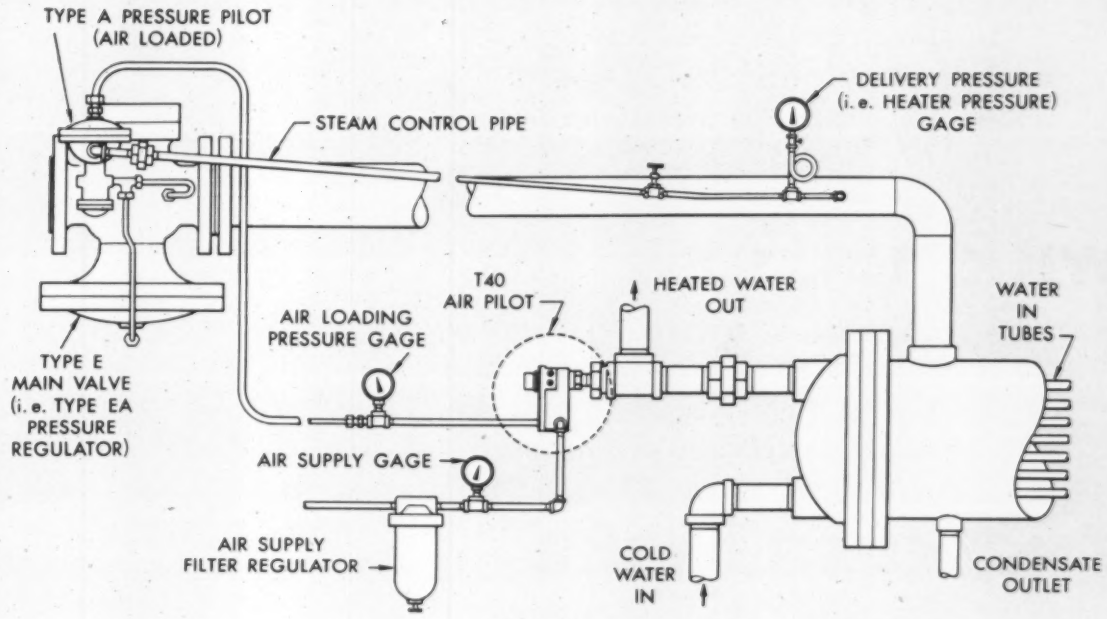
Extruded Aluminum Grilles and Registers Corrosion Resistant

Units of extruded aluminum do not rust, pit, or corrode. Provide every directional air flow and volume control. Face of units etched and coated with a protective acrylic coating. — *Hart & Cooley Manufacturing Co., Holland, Mich.*

Packaged Boilers In Sizes Up To 69,500 Sq Ft EDR Steam

Steel packaged boilers supply 2085 to 69,500 sq ft EDR gross steam, firing gas, oil, or oil-gas. Small diameter rear access door permits periodic inspection without removing bolted rear door. Gasketed front doors permit cleaning of tubes without disturbing burner or fuel and electrical connections. Fuel switch-over accomplished by fuel selector switch. Units built in accordance with ASME Code; burner and controls UL approved. Bulletin 601 sent on request. — *Arkos Manufacturing Co., 7310 Woodward Ave., Detroit 2.*

New Spence Temperature Control System Gives Unusual Control Accuracy


TYPE A PRESSURE PILOT (AIR LOADED)
STEAM CONTROL PIPE
DELIVERY PRESSURE (i.e. HEATER PRESSURE) GAGE
T40 AIR PILOT
HEATED WATER OUT
WATER IN TUBES
AIR LOADING PRESSURE GAGE
TYPE E MAIN VALVE (i.e. TYPE EA PRESSURE REGULATOR)
AIR SUPPLY GAGE
AIR SUPPLY FILTER REGULATOR
COLD WATER IN
CONDENSATE OUTLET

TYPE EAT40 AIR-CONTROL TEMPERATURE REGULATOR (Patent Pending)

In a recent installation the new Spence air-control temperature regulating system provided:

- ±5°F control accuracy under wide and instantaneous load swings of 210 to 80 gallons per minute.
- Up to 50% reduction in cost as compared to instrument systems of similar accuracy.

This unique cascade-type control with throttling range adjustment independent of maximum heater pressure was developed to meet today's demand for greater control accuracy.

Additional features of the new Spence Temperature Control System include:

- 200°F wide adjustable temperature range
- Adjustable speed of steam pressure change
- Over and under temperature protection
- Pressure limit control
- Fast response
- Very low air consumption
- Field reversible for heating or cooling

The Spence Type EAT Air Control Temperature System, when properly installed, will tame wide ranging, fast changing loads of instantaneous heaters and modern heat exchangers. The cascade principle plus the use of an extremely fast responding bi-metal temperature sensing element reduce time lags and provide control stability.

Here's how the new Spence system operates:

Quick response is based on a bi-metal temperature sensing element. Temperature pilot continuously regulates a loading air pressure.

This loading signal, when applied to a pressure regulator to reflect heater temperatures, causes it to adjust the main valve as changes in load require.

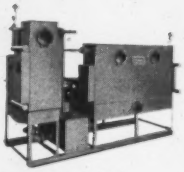
Spence has also developed a new pressure control system based on this same cascade principle. This system has a control accuracy of ½ psi or better from positive pressures through the vacuum range to 30" Hg.

For complete information on these new air controlled temperature and pressure control systems, write for your copy of Bulletin 9.

SPENCE ENGINEERING COMPANY, INC.
Walden 1, New York SE-148

NEW DURABLE KATHABAR® SYSTEMS

offer high performance with new low maintenance for years of troublefree service



LOW MAINTENANCE

Rugged new Kathabar design provides all-nickel regenerator, separate from rest of system, to prevent condensation corrosion. Breaking all records for low maintenance, all over the world.

WIDE USAGE

Successfully applied in wide range of industries, hospitals, buildings. Easily provide conditions of 80° F and 35% RH to 30° F and 10% RH. Deliver air at -90° F dew point.

ENGINEERS LIKE

Consulting engineers like the Kathabar system: no re-heat, no frost, no chemical carryover. Humidity, independent of dry bulb, controlled with no reversing or interruption for regeneration.

GET FACTS

SURFACE COMBUSTION
A division of Midland Ross Corporation
2384 Dorr Street, Toledo 1, Ohio
Send facts on Kathabar systems for following application:

name & title .....
company .....
street .....
city ..... *zone* ..... *state* .....

59-7

In Europe: NEDAIRCO, The Hague. In Japan: CHUGAIRO, Osaka.

EQUIPMENT DEVELOPMENTS
Continued

Balancing Vent Ell Has Triple Function

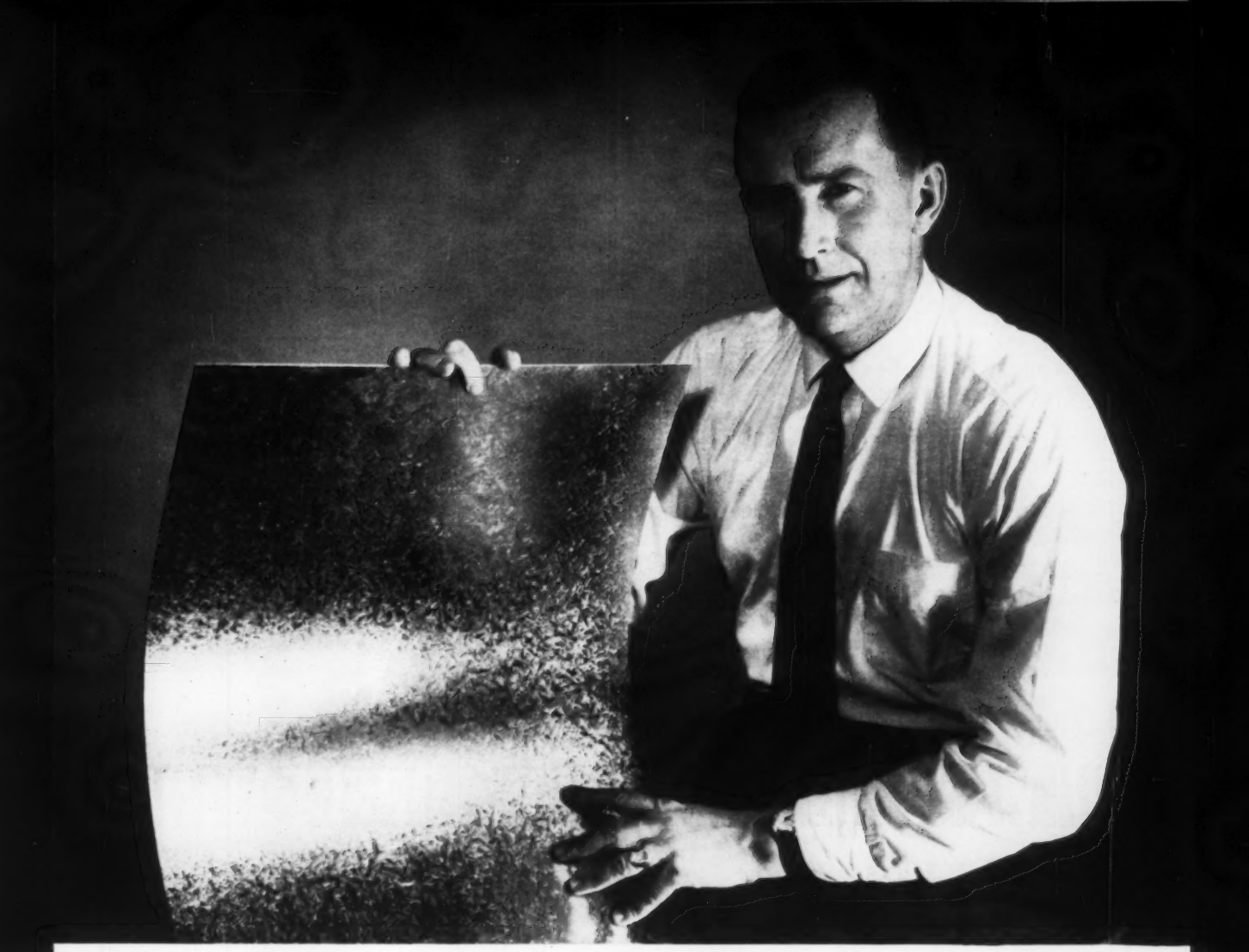
Elbow has vent chamber and diverter to change flow rate through fitting. Can be installed inside baseboard covers for balancing and venting of one pipe heating systems. Installed inverted, unit serves as drain instead of vent. Can be used with convectors, unit heaters, radiators, and other equipment. Fits under baseboard covers. Available in $\frac{1}{2} \times \frac{3}{4}$ in. (BVE-1), $\frac{3}{4} \times \frac{3}{4}$ in. (BVE-2), and 1×1 in. (BVE-3) sizes. Equipped with $\frac{1}{8}$ in. hex brass pipe plug for manual venting; automatic air vent optional. — *H. A. Thrush & Co., Peru, Ind.*

Machine Cuts Up To 4 In. Solids and Most 6 In. Shapes

Abrasive cutting machine uses oscillating feature to cut solids up to 4 in. and most 6 in. shapes. Cuts at a rate of 3 to 4 sec per sq in.; powered by 20 hp motor. Available with air-operated power head. — *Beaver Pipe Tools, Inc., Warren, O.*

Air Diffuser and Light Available in Single Fixture

Combination air diffuser and light fixture in a single unit for use in any building with a drop ceiling. Fiber glass insulation isolates air passageway from troffer housing. Handles up to 200 cfm. — *Thomas Industries Inc., 207 E. Broadway, Louisville, Ky., and Tuttle & Bailey, Div. of Allied Thermal Corp., 215 Warren St., New Britain, Conn.*



Why Bethcon Galvanized Sheet makes the best ductwork

When you flex a piece of Bethcon galvanized sheet steel, you notice it has a "feel" of its own, a certain extra something. Liveliness, if you will. Toughness, perhaps. Or strength with ductility. Whatever you choose to call it, you'll find that it sinews the Bethcon sheet to form up into a strong, rigid end product.

There's good reason for Bethcon's unique quality. Bethlehem's continuous galvanizing lines include a special annealing cycle which imparts to the basic steel the strength-with-ductility that makes the sheet so desirable. Seconds later, the rich coating of zinc is applied so tightly that it permits forming never considered practical for galvanized steel.

If you have not yet familiarized yourself with Bethcon, you might like to talk to someone who has. Or perhaps you'd prefer to discuss it with one of Bethlehem's representatives. Either way, you'll get prompt attention by getting in touch with our nearest sales office.

Galvanized Steel

for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, Bethlehem, Pa.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

EQUIPMENT DEVELOPMENTS

Continued

Radial Air Gap Motors Have Flange Mounted Construction

Reduced dimension motors rated from ½ to 25 hp in speeds 900 through 3600 rpm in three basic frame sizes. Choice of four different flange diameters in 1, 1½, and 2 hp ratings and a 13 in. diameter flange in 1 to 10 hp sizes. Cast iron housing totally enclosed, non-ventilated, and fan-cooled construction available; rated 99 F. Normal and high torque, continuous and intermittent duty, single and multi-speed designs. — *Fairbanks, Morse & Co., Electrical Div., Freeport, Ill.*

Thermostatic Steam Traps For Radiator Service

Thermostatic unit regulates steam flow and condensate removal with stainless steel bi-metallic control element. Operation of pressure balanced valve unaffected by pressure change. Unit has forged bronze body; internal parts of stainless steel. Available in ½ and ¾ in. sizes in angle, straightway, and angle-union patterns. Catalog FE-310 sent on request. — *Farris Engineering Corp., Mil Div., 563 Commercial Ave., Palisades Park, N.J.*

Air Filter Inflates When in Operation

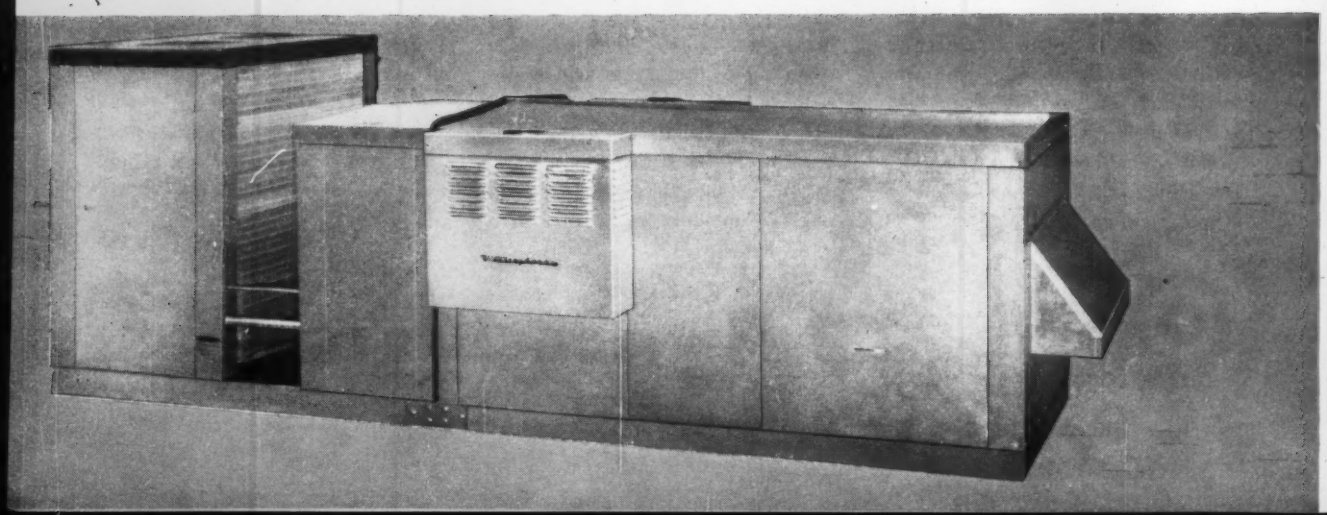
Dry-type disposable air filter inflates when ventilation system is in operation and collapses when system is shut down. Frame available in three arrangements: front access with or without pre-filter and rear access without pre-filter. Three standard sizes (inflated): 24 × 24 × 36 in.; 12 × 24 × 36 in.; and 24 × 24 × 18 in. First size rated at 2000 cfm and provides 95 sq ft of filtering media surface; velocity through media, 21 fpm. — *American Air Filter Co., Inc., 215 Central Ave., Louisville 8, Ky.*

Air Diffuser for Separate Installation to Troffers

Air diffuser for use with air handling troffers manufactured by different firms. Installation of air diffuser by mechanical contractor; troffer by electrical contractor. "CLD" unit of the aspirating type discharges supply air without smudging. — *Anemostat Corp. of America, 10 E. 39th St., New York 16.*

NEW WESTINGHOUSE ROOFTOP HEATING-

new rooftop unit
swings into place
in minutes



EQUIPMENT DEVELOPMENTS

Continued

Ventilator Opens, Closes Without Outside Power

Unit opens and closes automatically with variations in temperature without using outside power sources. Movable louvers controlled by factory-set thermostat, opening at 70 F, closing at 50 F. Seven models available; most models have mesh insect screens and a fusible link that melts in case of fire, closing louvers and stopping air circulation. — *Thermvent Corp.*, 12861 *Artesian St., Detroit* 23.

Miniature Valve for 1/8 In. OD Tubing

Series "O" valve for use with 1/8 in. OD tubing to pressures of 3000 psi at room temperatures. Orifice 0.08 in. Available in brass and 316 stainless steel. Straight pattern, forged body unit 2¼ in. high. Features panel mounting; colored handles for color coding; "Teflon" cylinder packing; micro-regulating and non-regulating stems. Also available with 1/8 in. male pipe ends. — *Whitey Research Tool Co.*, 5525 *Marshall St., Oakland* 8, *Calif.*

Abrasive Cutting Machine For Up To 3 In. Shapes

Unit cuts up to 3 in. shapes and 1½ in. solids. Uses 11 in. diameter wheel with a 1 in. bore; equipped with drive pins. Screw-type vise holds work in place while cutting is in progress. Unit weighs 136 lb. stands 21½ in. tall. Can be mounted on a stand or workbench. — *Beaver Pipe Tools, Inc., Warren, O.*

Solenoid Valve Controls High Pressure Fluid Lines

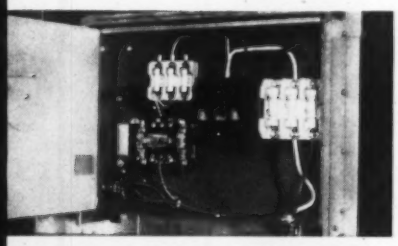
Straight through flow solenoid valve for use in gas and liquid fluid control. Operates in any position with maximum rate of 1000 cycles per min at 100 psi. Will serve under pressures up to 200 psi in temperatures ranging from −65 to 350 F. Available in 6 to 64 v d-c; 6, 12, 24, and 110 to 220 v, 60 cycle a-c; and 110 v, 400 cycle a-c models. Inlet connection ½ in.; outlet connection 1/8 in. Features self-supporting, in-line mounting. — *General Magnetics, Inc.*, 2641 *S. Louisiana Ave., Minneapolis* 26.

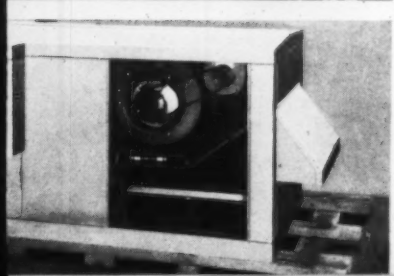
COOLING UNIT SLASHES INSTALLATION TIME

Here's a Westinghouse package that has everything your customers want in air conditioning . . . and gets you off the job fast! It's a self-contained, combination heating and cooling unit specially designed for rooftop installation on single-story commercial or industrial buildings.

A glance at the features shows why the CRU is simplest of all to install. Fully assembled, a 7½-hp unit weighs only 2200 pounds—splits in two, to simplify rigging and handling.

What does this new Westinghouse development offer your customers? Turn the page.



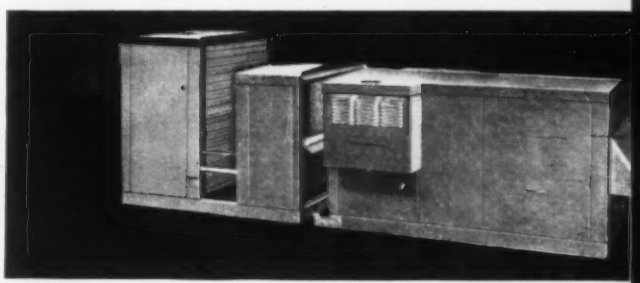


SECTIONAL CONSTRUCTION permits quick installation. Westinghouse CRU is divided into separate heating and cooling sections . . . each prewired.

FACTORY-INSTALLED REFRIGERANT PIPING CONNECTIONS AND WIRING. Cooling unit is precharged with refrigerant and tested. Weatherproof control panel installed.

EASILY REMOVED PANELS give immediate access to fan, fan motor and drive, filters, burners. No sheet metal screws to slow things down.

"CAN'T-LEAK" CHANNEL JOINTS. Specially designed panel and frame joints keep water out.



J-85051-1

Westinghouse

EQUIPMENT DEVELOPMENTS

Continued

Connector Valve for Test Pressures to 1000 Psi

Filling connector and retaining collar permit connection of pressure lines to tanks and other vessels with pressures up to 1000 psi. Hand cam lever causes flanged rubber bushing to expand in opening to be sealed; retaining collar holds bushing in place. Tapped hole in filling connector body to accomodate fitting on end of pressure line. Units for use on pipe sizes to 4 in. — *Mechanical Products Corp., 1716 W. Hubbard St., Chicago 22.*

Cryogenic Insulating Fill Has Low Thermal Conductivity

Synthetic calcium silicate "Micro-Cel T-4" has an apparent mean thermal conductivity of 0.1 Btu per sq ft per in. per hr per F as determined between liquid nitrogen and ambient temperature at atmospheric pressure. As an evacuated powder, "Micro-Cel" grades have apparent mean thermal conductivity values ranging from 5.5 to 7.5 microwatts per cm per K as determined at an absolute pressure at one micron of Hg. Explosion-proof and fire resistant, material compatible with commonly used liquid gases such as oxygen and hydrogen. Loose weight density 4½ to 6 lb per cu ft; packed density 6 to 9 lb per cu ft. — *Johns-Manville Celite Div., 22 E. 40th St., New York 16.*

Industrial Water Heater Unit Has Replaceable Element

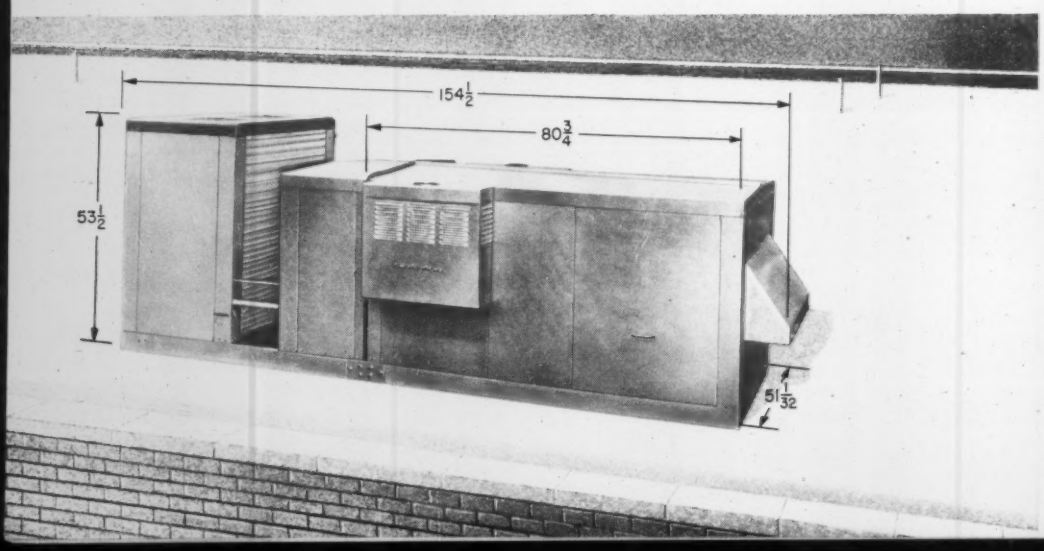
Model "139P" hot water tank heating unit has replaceable hairpin heating element having an output of 7 kw, single-phase. For replacement of 1 in. IPS one-piece screw-plug units. Varistor-protected and copper sheathed for corrosion protection. Prevents lime accumulations. — *Thermo-Craft Electric Corp., 429 E. 164th St., New York 56.*

Ventilator Curb Features Deep Mounting Flange

Deep mounting flange allows flexibility for inserting unit in roof opening. Aluminum thermal-acoustic curb provides insulation to prevent rusting and rotting damage to building. Spun fiber glass absorbs noise and reduces reverberation; neoprene coat prevents absorbtion of fumes. Includes mounting shelf for self-acting louver. Neoprene cushion for self-sealing fit for fan mounting. — *Davidson Fan Co., Dept. 14, 213 California St., Newton 58, Mass.*

THE ALL-NEW WESTINGHOUSE CRU

roof-mounted heating-cooling unit frees floor space for productive use



ALUMINUM CASING never needs painting, won't chip, crack or peel—provides complete protection for air handling system.

ONE-YEAR WARRANTY on entire unit with additional four-year warranty on motor compressor . . . your assurance of quality.

QUIET OPERATION: With all moving parts outside the space, you are assured of quiet operation.

EQUIPMENT DEVELOPMENTS

Continued

Insulation Sealing Tape for Flexible Fibrous Glass Seams

Pressure-sensitive tape for sealing flexible fibrous glass thermal insulation seams. Provides positive moisture vapor barrier and holds insulation in position on sheet metal air conditioning ducts. Also used to attach and seal flexible duct connectors and as a patch material for torn or punctured vapor barrier facing. "Permacel 691" has plastic impregnated cotton cloth backing coated with adhesive; meets Government Specification PP-T-60. — *Permacel, New Brunswick, N.J.*

Sheet Metal Punch Gangnotches Up To 16 Gage Mild Steel Sheets

Machine for single-stroke hydraulic gangnotching of sheet metal duct-work. Up to five notches can be made on 16 gage mild steel or equivalent thickness in stacked lighter gages. Quick-disconnect fittings can make any punch unit inoperative. Automatic relief valve protects punches and dies from overload damage. Unit includes hydraulic pump, 3 hp motor, oil-reservoir, and solenoid main operating valve. Standard tooling includes three 10 deg v-notch and two 115 deg end-notch punch and die sets. — *The Lockformer Co., Dept. HA-8, 1615 W. Roosevelt Rd., Chicago 50.*

Manual Starter for Fractional Hp Motors

Units provide manual, across-the-line, start-stop or off-on control of fractional and 1 hp single phase electric motors. Single and two-pole devices include built-in trip-free thermal relay to protect motor from sustained overload. Optional equipment includes incandescent or neon pilot lights to indicate operational status and toggle guards that can be padlocked. Two starters or a starter and toggle selector switch in a single enclosure also available. Bulletin 10-B1 sent on request. — *Furnas Electric Co., 1041 McKee St., Batavia, Ill.*

Damper Regulator Has Automatic 100 Percent Seal

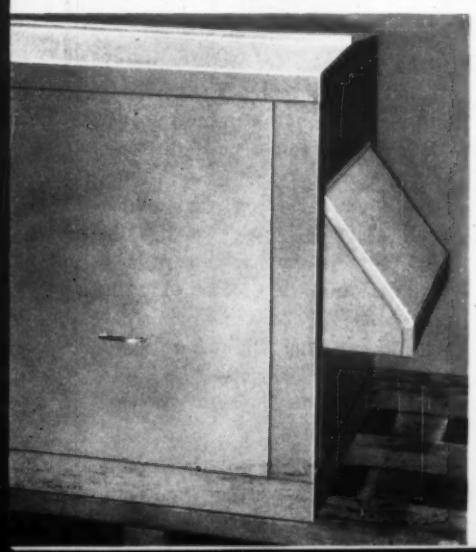
Damper regulator for duct work and high velocity systems. Polyethelene sealer component on quadrant handle prevents air leakage at square end bearing of damper blade. "Swivel" end bearing provided with damper regulator set. Unit turns freely on a brass bearing in an enclosed housing; prevents end bearings from becoming disconnected and ducts from "bellying." Bulletin sent on request. — *Elgen Manufacturing Corp., 32-49 Gale Ave., L.I. City 1, N.Y.*

SAVES VALUABLE FLOOR SPACE

Every square foot of a one-story, commercial or industrial building can now be turned into useful space, because the new Westinghouse combination heating and cooling unit sits on the roof. That's why your customers will also find this space-saver ideal for existing buildings. A Westinghouse CRU installation requires no major building alterations.

This new Westinghouse unit provides an economical answer to many air conditioning problems. The CRU is economical to operate and maintain, super-quiet. It has famous Westinghouse quality.

Want to know more? Call your nearest Westinghouse air conditioning distributor or fill out and mail the coupon today. *You can be sure . . . if it's Westinghouse.*



Mr. Roy L. Sherrill, Jr.
Westinghouse Electric Corporation
Air Conditioning Division
P. O. Box 510, Staunton, Virginia

I want more facts on the Westinghouse CRU combination heating and cooling unit for rooftop installation.

Please (check one) ☐ Send me more technical data. ☐ Have your sales representative call.

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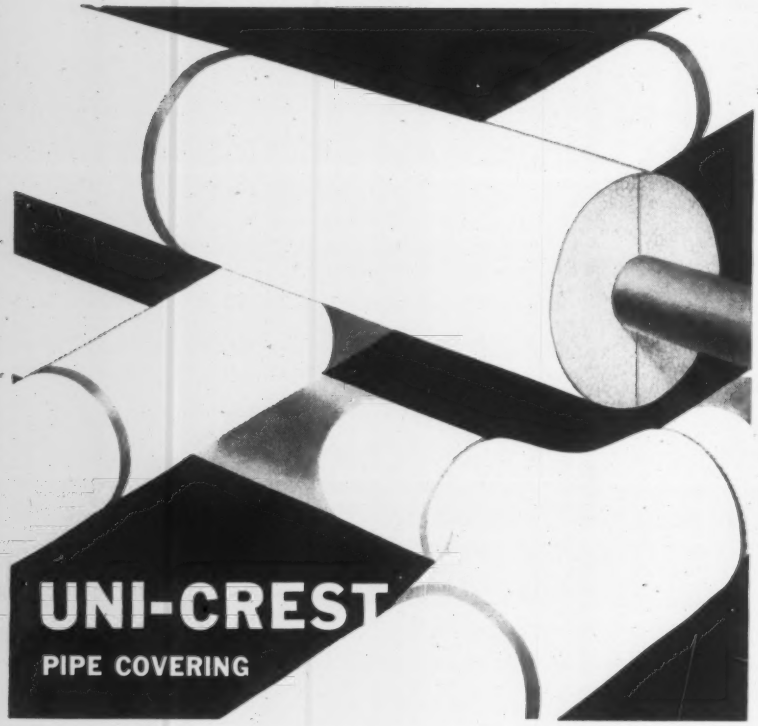
Westinghouse



a new, economical, low temperature insulation

Uni-Crest expanded polystyrene pipe covering is an excellent low temperature insulating material, and is inexpensive to install and maintain.

Its low thermal conductivity (K factor) plus its high resistance to water and water vapor — are some of its prime qualities. It will not rot, mildew, or support fungus growth.

Extremely lightweight, with a smooth, tough white surface, Uni-Crest is non-dusting, non-flaking, and easily cut and handled on the job.

Uni-Crest and self-extinguishing Uni-Crest are available in a wide variety of sizes and shapes. Both types are also available with or without a paper and foil laminate jacket.

For the address of the office nearest you, plus additional information and an actual sample, please write to the address below.

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Since 1907

UNITED'S UNI-CREST EXPANDED POLYSTYRENE

1 Central Avenue, Kearny, New Jersey

BRANCH OFFICES OR APPROVED DISTRIBUTORS IN ALL KEY CITIES

EQUIPMENT DEVELOPMENTS
Continued

Room Air Conditioners for Hospitals, Offices, Hotels

Units have individual control of cooling, heating, dehumidifying, filtering, and introducing outside air. Face and by-pass damper control provides continuous air circulation with modulated seating, cooling, or dehumidifying; control manual or automatic. Maintains constant pumping head, reducing possibility of freeze-up. "Angle fin" permits straight through air flow. "Unitaires" have one-piece tapped winding-type motor and fan assembly. Motors resiliently mounted. — *Airtherm Manufacturing Co., P.O. Box 7039, St. Louis 77, Mo.*

Grilles, Registers, Made Of All Extruded Aluminum

Units of all extruded aluminum feature heliarc welded corners. Various types, sizes, and shapes available. Bulletin GEX-2-60 sent on request. — *General Air Products Corp., 14-10 Factory St., Cedar Grove, N.J.*

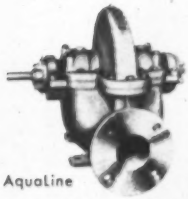
Recorder, Controller for Protective Gas Atmospheres

Unit automatically records and controls dewpoint of protective gas atmosphere used in heat treating, brazing, and sintering operations. Sensing unit is a relative humidity device that can be calibrated in degrees F dewpoint; eliminates condensation and evaporation of water vapor and its extraneous contaminants of gas sample. — *Barber-Colman Co., 1701 Rock St., Rockford, Ill.*

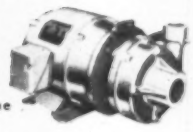
THESE QUALITY PUMPS CUT COSTLY SERVICE CALLS

PEERLESS PUMP

PEERLESS END SUCTION AND SIDE SUCTION AIR CONDITIONING PUMPS COST LESS—LAST LONGER



AquaLine



Fluidyne

PEERLESS AQUALINE® Pumps are available in sizes to 8-inches. Capacities to 2600 gpm, heads to 280 feet. Temperatures to 250°F. Horizontal split case design allows quick inspection without disturbing piping.

PEERLESS FLUIDYNE® Pumps are compact end-suction design. Redi-Packed in 22 sizes from 1 x 2 x 6 to 2½ x 3 x 10, for immediate shipment. Heads to 230 feet, capacities to 300 gpm, motors from 1 to 15 hp.

If there is a key word to describe Peerless Pumps, that word is QUALITY. You'll find it in the way the pumps are designed. You'll find it in the way the pumps are made. And you'll find it most apparent in the way these pumps operate. Remarkably long trouble-free operating records are routine with these better-made pumps.

But QUALITY is just the start of a long list of important features that recommend the Peerless AquaLine and Fluidyne line of pumps for your water handling jobs. There's immediate availability from ready-to-ship stocks. Complete hydraulic coverage for every type of application. Compact streamlined design that gives you space-saving good-looking layouts. And fast, on-time service from a network of warehouses and field offices. Get the full story of these superior pumps. Request more information today.

ATTENTION DEALERS: A limited number of Peerless AquaLine and Fluidyne pump dealerships are available. Please write for complete information.

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- ☐ Bulletin B-2100 on Peerless Aqualine Pumps.
- ☐ Name and address of nearest Peerless Dealer.

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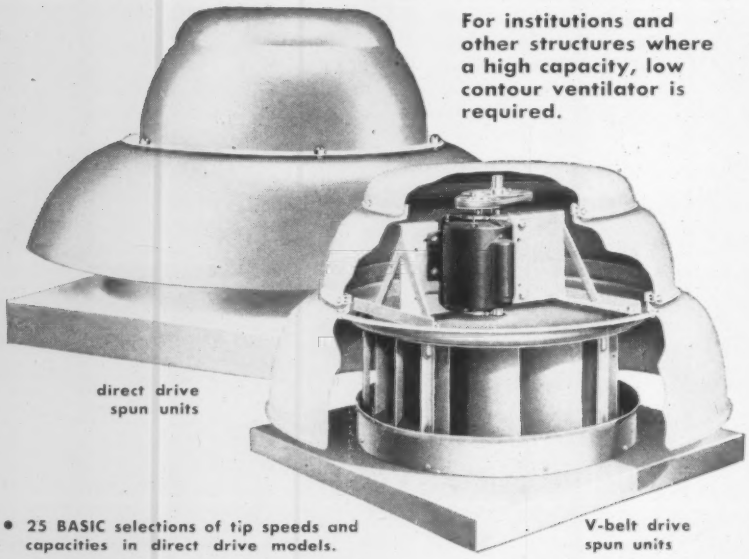
NEW Burt Spun Aluminum

Direct and V-Belt Drive Centriflow Fan Ventilators

For institutions and other structures where a high capacity, low contour ventilator is required.



direct drive spun units

V-belt drive spun units

- 25 BASIC selections of tip speeds and capacities in direct drive models.
- 64 BASIC selections of tip speeds and capacities in V-belt drive models.
- CAPACITIES from 65 to 27,648 CFM.
- HORSEPOWER ratings from 1/60 to 7½.
- SIZES from 6" through 48" wheel diameters.
- STATIC PRESSURE range from 0" through 1" W.G. (higher static pressures on application).
- LOW PROFILE heavy gauge spun aluminum housings.
- NON-OVERLOADING backward curved, non-sparking aluminum fan wheels.
- ADJUSTABLE SHEAVES on V-belt units to change capacities at anytime.
- DAMPERS available in drop-in sleeve type, automatic back-draft or motor operated.
- BURT DESIGNED for minimum noise levels.
- AMCA CERTIFIED capacity ratings for units of 16" wheel diameter and larger.

Send for **FREE** *Data Book!*

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MEMBER AIR MOVING & CONDITIONING ASSOCIATION, INC.

EQUIPMENT DEVELOPMENTS

(Continued)

Gasket Compound for Various Types of Connections

Compound for sealing gasketed assemblies, repairing broken gaskets, building up damaged, misaligned, or warped flanged surfaces, or as a gasket substitute where surfaces permit. Can be used with water, steam, oil or water-based hydraulic fluids, LP and natural gases, mild corrosives, and many chemicals. Temperature range —65 to 400 F; pressures to 5000 psi. Available in both soft and hard setting types for semi or permanent connections. Withstands vibration, contraction, and expansion. — *Crane Packing Co., Dept. HA-3, 6400 Oakton St., Morton Grove, Ill.*

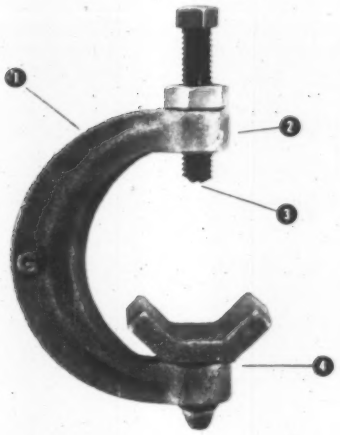
Pulley Drives Have 1½ to 16 In. Diameters

Units have heavy cross sections where pulley flanges merge. Available in ½, ⅝, ¾, and 1 in. bores with standard key way. Pulley diameters 1½ to 16 in. — *Tann Corp., Congress Drives Div., 3750 E. Outer Dr., Detroit 34.*

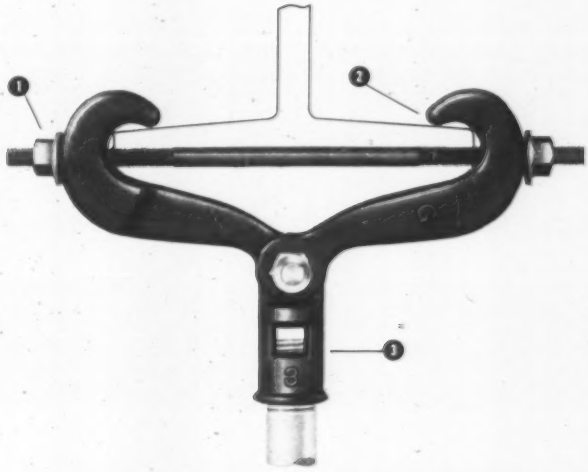
Electric Infrared Heaters Have Controlled Beam

Comfort units with metal sheath, quartz tube, or quartz lamp elements. Weatherproof housing shell of deep recess aluminized steel construction; reflector is polished aluminum. Eleven models from 8 to 54 11/16 in. available. Bulletin F72100 sent on request. — *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8.*

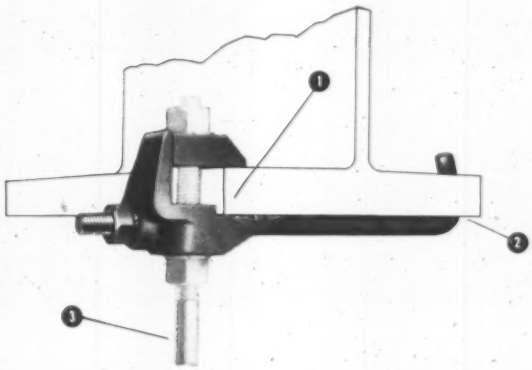
You get extra features...at no extra cost ...when you specify Grinnell Beam Clamps!



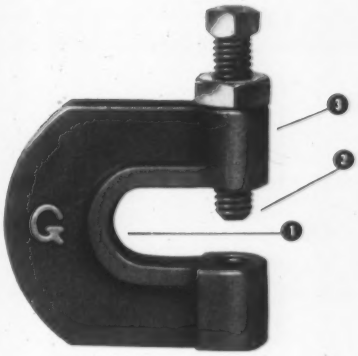
GRINNELL G-CLAMP HANGER, FIG. 92 — 1. Ribbed, malleable iron casting for greater strength, impact resistance. 2. Full thread engagement. 3. Hardened steel cup-point set screw for good "grip" on beam. 4. Saddle swivels 360°.



GRINNELL MALLEABLE BEAM CLAMP WITH EXTENSION PIECE, FIG. 229 — 1. Tie rod locks clamp in place when nuts are tightened. 2. One jaw size fits all beam flanges up to 7". 3. Malleable iron extension piece.



GRINNELL SIMPLEX SIDE I-BEAM CLAMP, FIG. 265 —1. 1¾" maximum jaw opening will take large beam flange thickness. 2. May be attached to beam of any flange width by merely ordering hook rod of suitable length. 3. Load ratings of 1,740 lbs.



GRINNELL G-CLAMP HANGER, FIG. 86 — 1. Ribbed, malleable iron casting for extra strength. 2. Hardened steel cup-point set screw for good "grip" on beam. 3. Full thread engagement — casting drilled and tapped for rod, set screw.

You get *more* Clamp for your money from Grinnell! Reason: Grinnell's huge volume reduces production costs . . . lowers prices right into line with competitive hangers that offer you much less.

Know what else you get with Grinnell Clamps? Wider choice of types and sizes! Better quality control! Published rating for *all* Clamps with a safety factor of at least 5 to 1! Faster delivery may be had from nationwide warehouses!

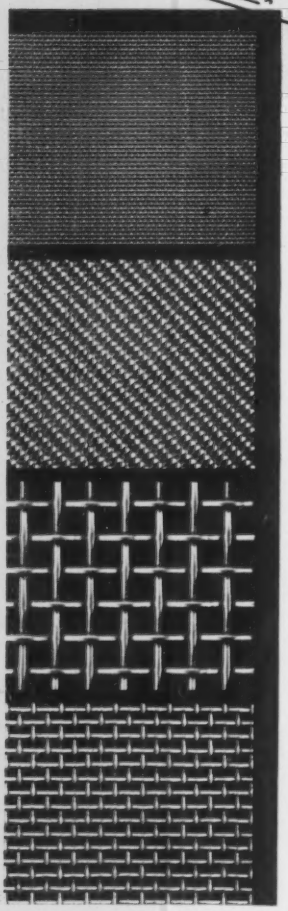
What's more, you always get dependable field service by trained Grinnell personnel . . . no matter how far from the job site the sale was made! Grinnell Company, Providence 1, Rhode Island.

Remember, The Best Costs No More — from America's #1 Supplier of Pipe Hangers and Supports

Call your local Grinnell Distributor for pipe hangers, cast and malleable iron fittings, steel nipples, welding fittings, Grinnell-Saunders Valves, unit heaters — all made by

GRINNELL

new technology in
WOVEN WIRE CLOTH
for gas fired
INFRA-RED BURNERS



More and more manufacturers are using woven wire cloth as the most practical burning surface for gas fired Infra-Red Heaters. Woven wire cloth has proved its efficiency and economy for both pre-mix and gravity type burners. What's more, woven wire is rugged and reliable—withstands the rigors of expansion and vibration—endures broad ranges of temperature cycling.

The majority of Infra-Red users of woven wire cloth rely on Cleveland Wire Cloth to supply their requirements and for good reason. We have cooperated with combustion engineers, taking their specifications and designing them into highly efficient woven wire Infra-Red burners. Through continued research, we are developing new and better applications for woven wire cloth burning surfaces. Let us apply this new technology to your Infra-Red burning problems.

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EQUIPMENT DEVELOPMENTS

Continued

Portable Nibbler Cuts Corrugated Steel

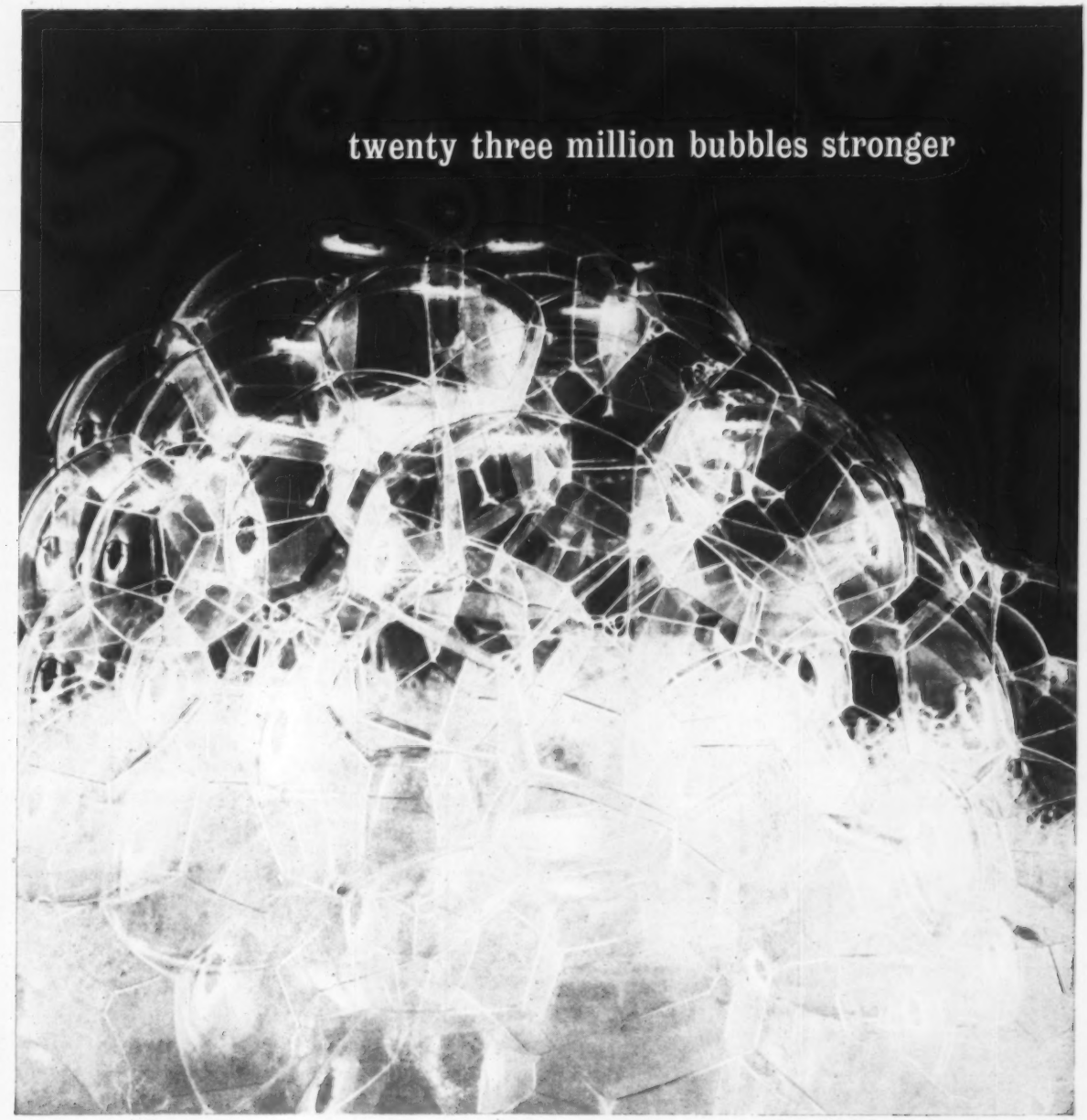
Unit cuts corrugated steel when an adjustment of its cutting head is made. Operates on a punch and die principle. Cut edges do not require deburring, grinding, or buffing. Cut pieces of metal fall directly beneath work, preventing injury to worker. Light, medium, heavy, and extra-heavy models available for cutting materials up to $\frac{1}{4}$ in. steel and 5/16 in. aluminum. Cuts inside circles, squares, and odd-shaped holes. — *Fenway Co., Inc., 1910 N. Marshall St., Philadelphia 22.*

Two Electric Drills Have Ball Bearing Construction

Drills in $\frac{1}{4}$ and $\frac{3}{8}$ in. models. Smaller model has 2.5 amp motor and helical gears. Larger model has 2.8 amp motor and an auxiliary side handle. Both units have die cast aluminum housings. — *Skil Corp., 5033 Elston Ave., Chicago 30.*

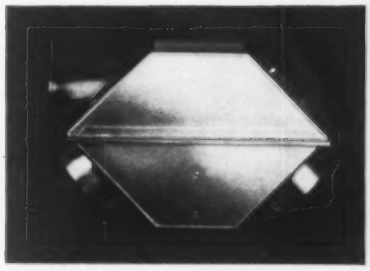
Portable Potentiometer Has 0.5 Percent Accuracy

Unit has suppressed ranges from −300 to 3000 F, with one half of one percent accuracy. Can be used for checking inlet and outlet on cooling towers; motor or motor bearings; compressor heads; surface temperatures; pipe temperatures; and other applications. Features automatic reference junction, shock mounted jewels, and interchangeable thermocouples. — *Pyrometer Service Co., 348 River Rd., North Arlington, N.J.*



Bubbles make Buensod's new, improved air mixing valve stronger . . . 23,000,000* bubbles stronger. Research has led us to fill these new valves with polyurethane foam. The result is a better insulated valve with improved acoustical characteristics and far greater structural strength. And although the quality has gone up, the price hasn't.

This improvement is typical of the way Buensod-Stacey does business . . . always planning for a better product. The company that pioneered and developed Dual-Duct high velocity air conditioning has never stopped refining this advanced method of year 'round conditioning. There's a place for Dual-Duct in your next project, whether new structure or renovation. Your local Buensod rep will be glad to help. Call him.



*Approximate number of polyurethane foam cells found in the air mixing valve of Buensod-Stacey Type V under-window unit.

BUENSOD-STACEY

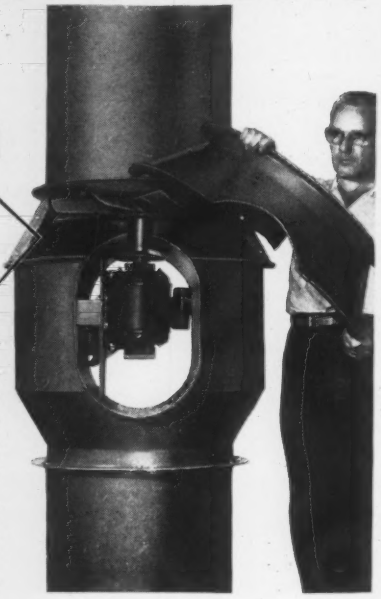
BUENSOD-STACEY CORP. • MANUFACTURED PRODUCTS DIVISION

45 West 18th Street, New York 11, N. Y. • A subsidiary of Aeronca Manufacturing Corporation

CUT MAINTENANCE COSTS

with this new design duct fan

Entire half of cone comes off . . . not just an access door . . . exclusive feature



While the DE BOTHEZAT® Bifurcator® **remains in the duct,** this new design duct fan provides an **easier, quicker** way to remove the fan wheel or motor . . . **speeds up** periodic inspections of fan wheel, bearings and extension shaft. The entire half of the cone unbolts and comes off, allowing plenty of room to work.

dependable . . . easy to install

Installation is as fast and simple as putting in a section of ductwork. DE BOTHEZAT direct drive motor, completely isolated from fumes and heat, insures steady, trouble-free operation over long periods. Ideal for handling corrosive fumes.

Write for literature. Use coupon below.

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American Machine and Metals, Inc.
East Moline, Illinois

Yes, I'm interested in cutting maintenance costs with DE BOTHEZAT Bifurcator Fans and the exclusive removable cone design. Please rush descriptive literature.

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Published ratings on DeBothezat Fans tell you exactly what the complete fan unit puts out. No guesswork — no allowance to be on safe side!

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EQUIPMENT DEVELOPMENTS

Continued

Sealing Adhesive For Duct Joints

Adhesive primarily for bonding polystyrene plastics and sealing duct joints. Has thick consistency and slow setting properties allowing application with a caulking gun. Provides seal against water vapor and heat loss. Remains pliable in temperatures from −35 to 300 F. — *Goodloe E. Moore Inc., 2811 N. Vermilion, Danville, Ill.*

Differential Pressure Switch Has 15 to 200 Psi Range

Pressure and pressure differential switch for use on all fluid lines. Opens or closes electrical circuit as required. Provides indication over 15 to 200 psi range; withstands pressures or overpressures to 5000 psi. Similar units available with actuation pressures from 0.25 in. water gage to 15 psi and from 200 to 5000 psi. Electric mechanism isolated from fluid. — *Pall Corp., 30 Sea Cliff Ave., Glen Cove, N.Y.*

Ball Valves for 0 to 800 Psi Service

Bronze, steel, and type 316 stainless steel units in ¼ to 2 in. sizes. Rated for 0 to 800 psi pressure with temperatures from −40 to 400 F. Two-directional units have chrome-plated ball and "Teflon" seats. Entire seating assembly can be removed while valve body remains in line; complete interchangeability of parts. Quarter-turn handle plastic-sheathed for insulation. — *Crane Co., 155 N. Wacker Dr., Chicago 6.*

EQUIPMENT DEVELOPMENTS

Continued

Packaged Boilers Have 25 to 100 Hp Capacities

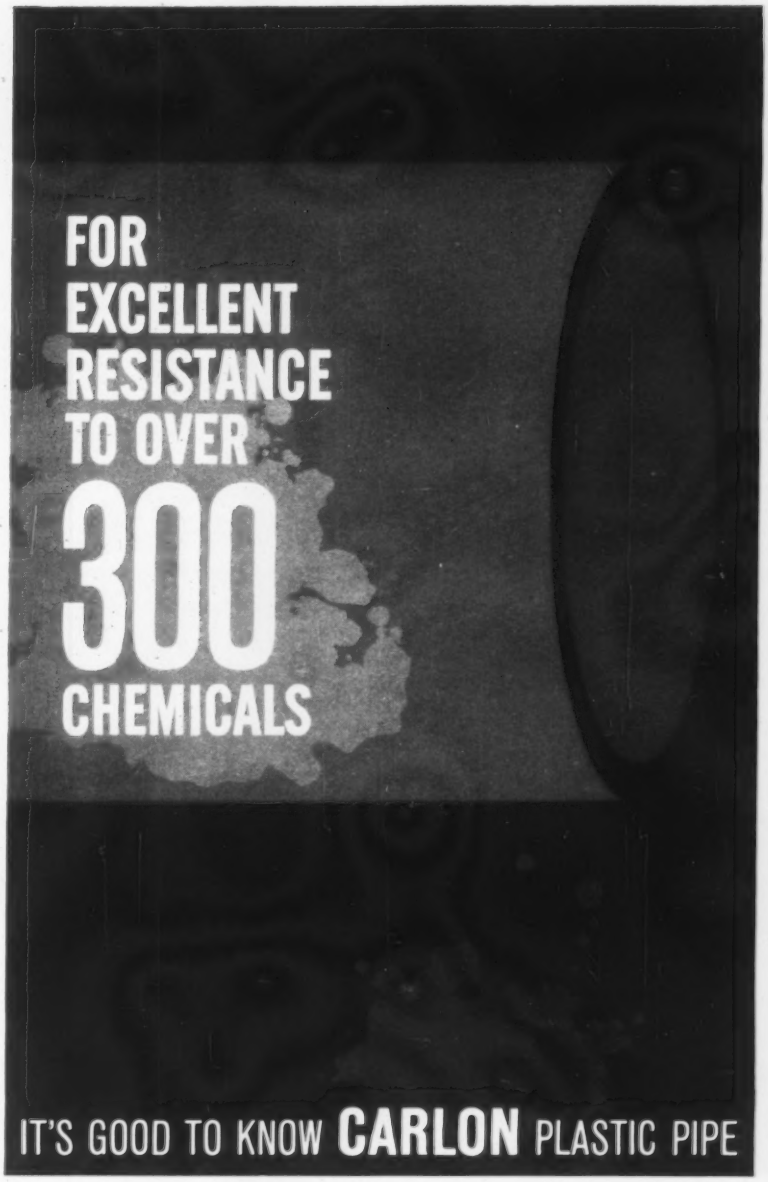
Fire tube packaged boilers have 25 to 100 hp capacities, firing gas, No. 2 oil, or a combination of gas and light oil. Can be used for steam, 15 to 250 psi, or hot water systems. Control panel located on front boiler head. Minimum efficiency, 80 percent. — *Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee 12.*

Crane Cab Unit Cools, Heats, Dehumidifies, and Filters

Ceiling mounted air conditioner cools, heats, dehumidifies, removes dust and filters odors and noxious fumes from air. "CE 23" can be used with firm's water or air cooled condensers. Electrostatic filter removes dust; activated charcoal filter removes fumes and odors. High pressure blower system includes two 6 in. centrifugal fans, moving 700 cfm. Heating capacity 13,600 Btu per hr. Bulletin No. 1003 sent on request. — *James Campbell Smith, Inc., Willoughby, O.*

Hydraulic Spray Nozzle Has Automatic Orifice Clean-Out

Unit has clean-out needle that automatically clears orifice with each on-off cycle of nozzle. Compressed air used to actuate valve; may be operated at speeds up to 180 cycles per min. Choice of interchangeable orifice tips available. Data Sheet 3561 sent on request. — *Spraying Systems Co., 3219 Randolph St., Bellwood, Ill.*



To help you make major pipe savings . . . Carlon's new Plastic Pipe Fact-pak. Includes chemical names, solution-strengths, operating temperatures and pressures. *Write for yours.*

KNOW THE FIRST NAME IN PLASTIC PIPE
CARLON

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Please send me the new Plastic Pipe Fact-pak.

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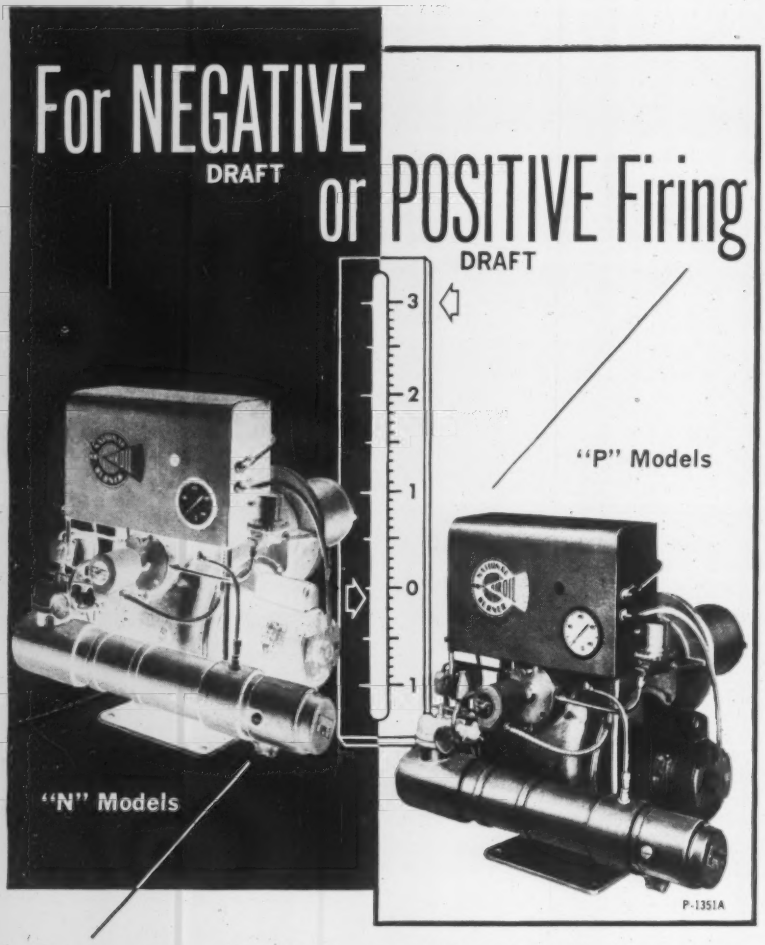
ADDRESS_____
CITY_____ STATE_____



Specify National Airoil Burners

Whatever your draft requirements . . . negative or positive . . . natural or induced draft, forced draft "pressurized" . . . there are TWO National Airoil **job-engineered** burners in 14 models available for top performance under the most severe service operations.

Select **TYPE C-45** for burning **Numbers 4 and 5** commercial fuel oils . . . **"N"** models operate with a **negative** draft of 0.05" w.c. to 21 gph, 0.075" w.c. to 33 gph . . . **"P"** models operate against a **positive** furnace pressure up to 3" w.c. . . quiet, easy to install, high temperature flame, excellent combustion, simple, sturdy construction, thoroughly field-tested and proved. Bulletin 100A.

Select **TYPE C-20**, a companion to the C-45 shown above, for burning the lighter **Number 2** fuel oil . . . **"N"** models operate with a **negative** draft of 0.05" w.c. to 21 gph, 0.075" w.c. to 33 gph . . . **"P"** models operate against a **positive** furnace pressure up to 3" w.c. . . . clean, pulsation-free operation. Bulletin 102.

These Underwriter-approved **packaged** burners offer many outstanding first-time features. Data is contained in our comprehensive literature and specifications. Just tell us your needs and you'll hear from us by return mail.

Established 1912
Incorporated 1917

NATIONAL AIROIL BURNER COMPANY, INC.
1284 E. Sedgley Avenue • Philadelphia 34, Pa., U.S.A.
Industrial Oil Burners, Gas Burners and Combustion Equipment

EQUIPMENT DEVELOPMENTS

Continued

Steel Bar Stock Valves For Flow Regulation

Valves used in continuous boiler (surface) systems, hydraulic service, instruments, throttling service, water column blowdown, soot blowers, boiler sampling service, and flow control of volatile liquids. Accuracy within 1 percent of desired flow. Pressure-temperature range up to 1500 psi at 800 F. Carbon steel or chrome-moly steel units available in connecting pipe sizes 3/8 to 2 in. Bulletin 169 sent on request. — *McAlear Manufacturing Co., 1901 S. Western Ave., Chicago 8.*

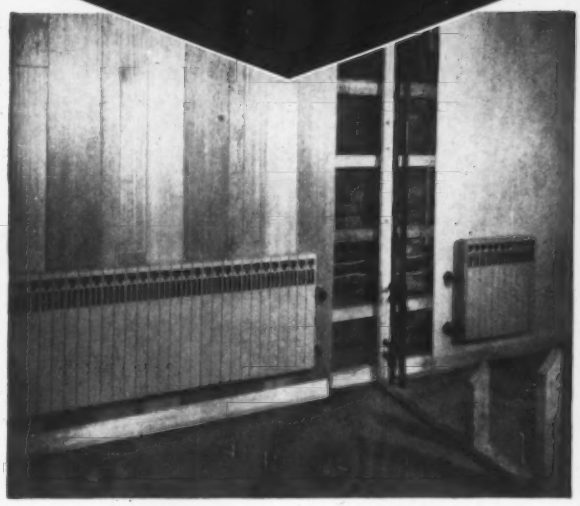
Hand Fastening Tool For Light Service

Unit for all light fastening to concrete, masonry, or light gage steel. Does not require extra attachments. Made of hardened steel parts and has a rubber grip. — *Gregory Industries, Inc., Lorain, O.*

Electrical Pressure Gage for 0 to 2500 Psig Range

Units for remote measurement, alarm, or control of pressure in air and gaseous systems. Range from 0 to 2500 psig. Electrical output can also be used for recording. Operation from 115 v a-c, 60 cycle line. Multi-position pressure gages utilizing up to five transducers with a single instrument also available. Transducers interchangeable without recalibration or adjustment. Specification Sheet No. 601 sent on request. — *Hastings-Raydist, Inc., Hampton, Va.*

REDUCE piping costs . . . SPEED installation



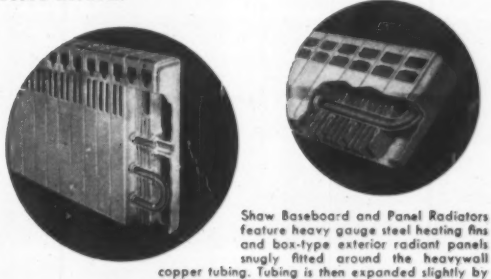
with

SHAW Radiators

Only Shaw, of all modern radiators, offers *same end* as well as opposite end tapping. Same end tapping has a place in almost every piping layout, and its use invariably means less piping materials, simplified pipe fitting.

Important savings in installation time are made with *any* Shaw model, regardless of tapping arrangement. Shaw units are compact, fully self-contained assemblies only 3" thick, easy to handle and mount. There are no dampers, or separate housings to fit and install.

Shaw Radiators distribute both radiant and convected heat in unvarying, health-guarding proportions that create natural thermal comfort in a room. They use either hot water or steam up to 150 psi. Write today for free literature on both panel and baseboard models.



Shaw Baseboard and Panel Radiators feature heavy gauge steel heating fins and box-type exterior radiant panels snugly fitted around the heavywall copper tubing. Tubing is then expanded slightly by 3750# hydraulic pressure to hold all components as a rigid, self-contained unit. The tight metal-to-metal bond assures rigidity and full heat conduction.

SHAW-PERKINS MANUFACTURING COMPANY
201 East Carson St. • Pittsburgh 19, Pa.

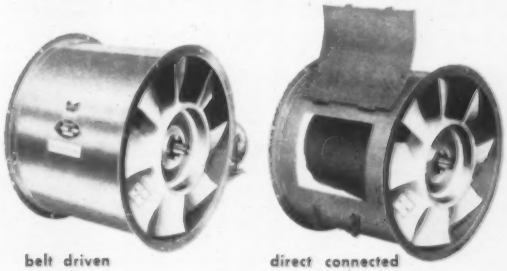
NEW 8 blade

Aerovent FANS

tubeaxial fans

high speed - high efficiency

Aerovent's new Tubeaxial Fan, designed around a new 8-blade "Macheta" Airfoil Axial Flow Propeller, offers top performance against medium pressures at speeds to 3450 RPM. Available in 16", 18", 24", and 30" diameters, this unit combines speed, stamina and modern functional design. Easily installed in present ductwork or engineered to new construction, it's the right answer for resistances to 4" SP. Another outstanding development from Aerovent—America's finest industrial fans and air equipment.



belt driven direct connected

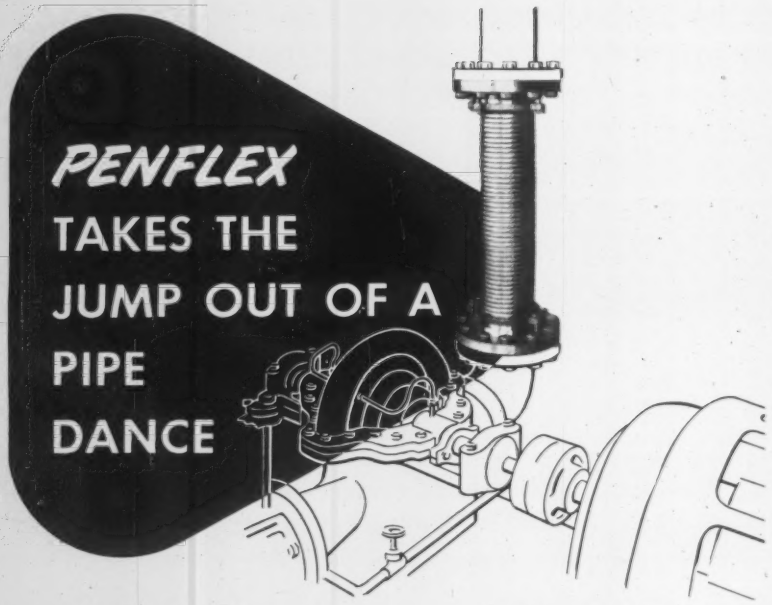
WRITE FOR FREE BULLETIN 350

Air deliveries of Aerovent equipment determined in accordance with established and accepted codes and guaranteed by manufacturer.

CERTIFIED PERFORMANCE

Aerovent FANS

Aerovent FAN COMPANY, INC.
ASH and BRANCH STS. PIQUA, OHIO



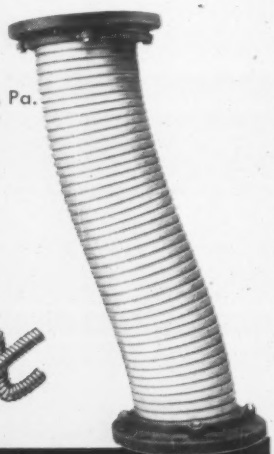
DAMPENS VIBRATION . . . CORRECTS
MISALIGNMENT . . . ABSORBS EXPANSION

When the lines get the jitters, the units get the breaks throughout the system. That's where a Penflex flexible connector should be installed.

These "Job-Proved" flexible connectors have been developed to soak-up the vibration in the refrigeration, heating and air conditioning lines in commercial and industrial installations. They correct the misalignment of pipes caused by pump or compressor motion and prevent pipe cracks and system breakdowns. As the lines become hotter or colder the Penflex connector expands or contracts . . . always assures a tight system with peak operating efficiency.

Flexible connectors, vibration dampeners, flexible lines have all been developed . . . thoroughly pre-tested by Penflex . . . and "job-proved" throughout the industry to be unsurpassed for trouble-free operating efficiency.

If you want your system to operate at its very best specify Penflex for flexibility at all temperature zones. Write for complete data to Pennsylvania Flexible Metallic Tubing Co., Paoli, Pa.



Penflex

TIGHT AS A PIPE . . . BUT FLEXIBLE

EQUIPMENT DEVELOPMENTS

Continued

Mounting Pads Eliminate Up To 90 Percent Vibration

Vibration damping mounting pads eliminate up to 90 percent of vibration induced by rotating or reciprocating impact-producing machinery and equipment; prevents creeping and crawling. Requires no bolting, lagging, or cementing. Material composed of two layers of vinyl chloride elastomeric resin, bonded to both sides of a reinforcing core of monofilament fiber glass. Breaking point 7500 psi; resists moisture, oils, greases, detergents, brine, solvents; and some other chemicals. Available in 22 × 23 ft sheets or cut to size. — *Lowell Industries, Inc., 125 High St., Boston 10.*

Sleeve Bearing Corrosion Resistant, Self Lubricating

"Teflon" reinforced sleeve bearing will not de-laminate when backed by metal. Unit corrosion resistant and self lubricating when used with stainless or monel metal outer shells. Other shells available. Literature on "Navajo" bearings sent on request. — *Industrial Plastic Supply Div., 574 New Park Ave., West Hartford 10, Conn.*

Roof Exhauster Has Motor Out of Air Stream

Unit with motor out of air stream is cradled on resilient mounts. Series "C" direct drive centrifugal units available in sizes from 7 to 18 in. Housing of spun aluminum. — *Greenheck Fan & Ventilator Corp., Schofield, Wis.*

EQUIPMENT DEVELOPMENTS

Continued

Press Brake Dies Feature Uniform Strength

Dies for bending and forming sheet and plate metals. Made of heat treated stress relieved, machine straightened alloy steel. Work surfaces smooth to cut friction and wear. Air bend dies of 30 to 90 deg; flattening and offset dies; three and four way dies; and 90 deg gooseneck punches stocked in 2, 4, 6, 8, 10, and 12 ft lengths. Special punches and dies available. Bulletin 92 sent on request. — *Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N.Y.*

Fractional Hp Motor 4 7/8 In. in Diameter

Fractional hp unit for use in window fans, direct drive blowers, and similar applications. Has 4⅞ in. diameter. Available in sizes from 1/20 to ¼ hp. Literature sent on request. — *Redmond Co., Inc., Owosso, Mich.*

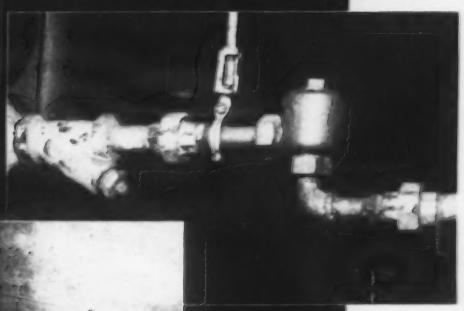
Pressure-Sensitive Tape Seals Both Insulation and Duct

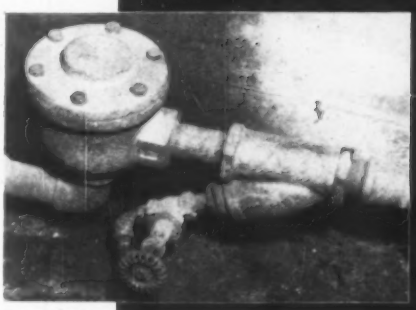
Adhesive tape for sealing flexible fibrous glass thermal insulation faced with aluminum foil—laminations of paper and aluminum foil and scrim cloth and aluminum foil. Also used for sealing sheet metal duct joints. Material has 0 moisture transmission creating a positive vapor barrier. Tape is a 3 mil dead soft aluminum foil coated with a quick sticking pressure-sensitive adhesive. Will adhere at temperatures below freezing. — *Permacel, New Brunswick, N.J.*

Consider These Facts about

THERMOSTATIC TRAPS

TO ASSURE HIGH EFFICIENCY AND LOW MAINTENANCE





Every trapping requirement cannot be met with one trap. Consequently Anderson manufactures a complete line of traps including the remarkable Quik-Flex Thermostatic Steam Trap. From one source you can meet all your trapping needs. If you are using or planning to use thermostatic traps, consider these important facts — features built into every Anderson Quik-Flex Trap.

- **Large capacity covering a wide pressure range simplifies specifications.**
- **Only one moving part assures low maintenance and less downtime.**
- **Fast heating up of units through quick discharge of condensate and/or air.**
- **Guaranteed freeze-proof when properly installed and operated for outdoor operation.**
- **Compact design permits simplified piping in hard-to-get-at places.**
- **Immediate delivery is guaranteed from inventory.**

Write FOR COMPLETE INFORMATION AND BULLETIN 257 DESCRIBING THE ANDERSON QUIK-FLEX THERMOSTATIC TRAP.

SUPER SILVERTOPS STEAM TRAPS

BY THE MANUFACTURERS OF Hi-eF PURIFIERS

THE V. D. ANDERSON COMPANY

Division of International Basic Economy Corporation

1949 West 96th Street • Cleveland 2, Ohio

SAVE SPACE and REDUCE COSTS

with

AURORA®

VERTICAL END-SUCTION PUMPS

Capacities to 1800 GPM
Heads to 1320 Feet

This close-couple, vertical mounting design provides the extreme compactness that is so important for the many applications where space allocation is critical. Flanged suction mounting cuts piping costs by direct mounting to tank. Separate foundation arrangement is eliminated along with any alignment problems. Optional discharge arrangement permits the most simplified installation.

The many desirable features of the Horizontal End Suction Pumps are retained . . . motor and rotary assembly easily removable without disturbing the suction or discharge piping . . . low NPSH . . . smooth quiet operation. Available in vertical base mounting design as well as close coupled or flexible coupled horizontal models.

WRITE TODAY FOR BULLETIN

AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
650 LOUCKS • AURORA, ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

EQUIPMENT DEVELOPMENTS

Continued

Polyester Foam Serves As Thermal Insulation

"Curon" polyester foam, laminated with 15 gage vinyl sheeting, serves as thermal insulation for processing equipment and storage tanks. For surface temperatures from 50 to 250 F. "K" factor 0.25 at 32 F; 0.38 at 250 F. Material has no affinity to water; poor capillary attraction of moisture. Will not rot, mold, or mildew. Insulation fastened by mastic cement, applied to surface to be insulated. Supplied in 4 × 12 ft sheets, 1 in. thick. — *Reeves Brothers, Inc., 1071 Ave. of the Americas, New York* 18.

Masonry Saw Blade Has Fiber Glass Reinforcement

"MR 824" for cutting lightweight block, dry press refractories, and softer types of stone. Layers of flexible fiber glass cloth woven into blade, making it break-resistive. — *Clipper Manufacturing Co., 2800 Warwick, Kansas City* 8.

Gas Pipe Line Filter Features Easy Cleaning Construction

Unit prevents clogging of furnace and appliance pilots by eliminating dirt, pipe scale, and other foreign matter from natural gas lines. Not necessary to break line for cleaning; one bolt loosens two aluminum sections, and filter can be washed in plain water and detergent. Available in ¾ and 1 in. sizes with female threaded inlet and outlet. Maximum safe operating pressure 125 psi. — *Rockwell-Standard Corp., Air-Maze Div., 25000 Miles Rd., Cleveland* 28.

EQUIPMENT DEVELOPMENTS

Continued

Air Dilution System Added To Airborne-Particle Monitor

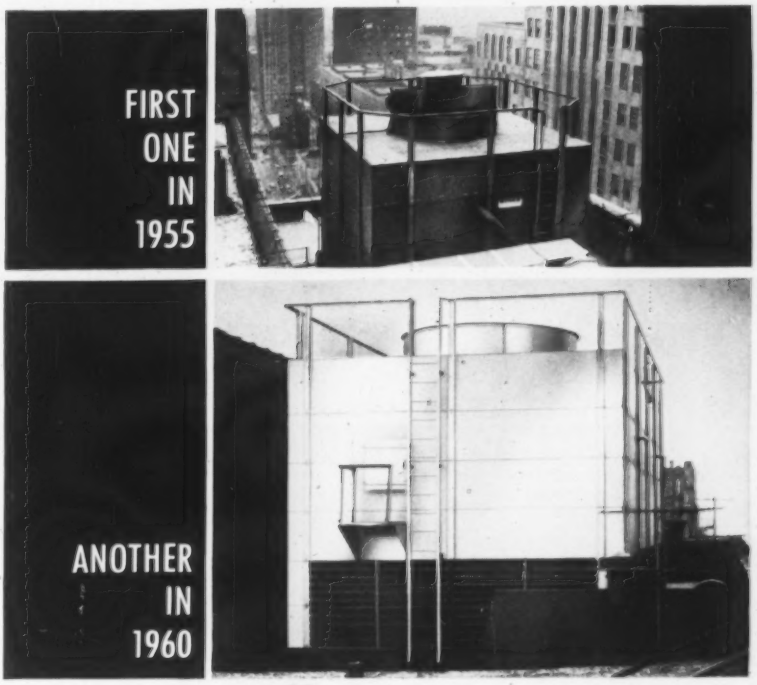
Air dilution system for use with firm's airborne-particle monitor or can be used in the laboratory for controlled mixing of air or gases. Provides a continuously variable addition of filtered dilution air from 0 to 200 cc per min to a basic sample. Gives dilution ratios from 0 to 50:1. Can be cut in or out instantaneously. — *Royce Instruments Inc., 440 Olive St., Palo Alto, Calif.*

Sheet Metal Brake for Straight, Box, and Pan Bending

Unit will bend any length from 1 to 48 in. (by $\frac{1}{2}$ in. increments) of 20 gage metal. Radius formers available in $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, and $1\frac{1}{4}$ in. radii with 4 in. widths. Two 16 in. nose bars and one each of $1\frac{1}{2}$, 2, 3, 4, and 6 in. fingers standard equipment. Catalog sent on request. — *Whitney Metal Tool Co., 724 Forbes St., Rockford, Ill.*

Zone Valves for Two-Pipe Hydronic Systems

Diaphragm type zone valve for use on two-pipe hydronic heating and cooling systems. Operated by electromagnetic coil and pilot valve; controlled by low voltage a-c, d-c thermostat. Has hydraulically-operated "Buna-N" diaphragm. Can be installed in any position on feed lines of heating or cooling units, or on return header at boiler. Catalog ZV-1060 sent on request. — *Hoffman Valves, 2360 W. Dorothy Lane, Dayton 39, O.*



The LaSalle Hotel, Chicago...

Saves $486.80 per day with Binks cooling towers!

"Without our Binks cooling towers our water bill would run $500 a day. As it is we pay only $13.20 per day for 86,000 gallons of makeup water . . . a savings of $486.80," reports Mr. J. E. Petermann, chief engineer of the LaSalle Hotel.

This 1000-room hotel now has two Binks 2-K cooling towers, one 2-fan unit installed in 1960 and a separate 1-fan tower which has been operating since 1955.

The new 2-K tower replaced a smaller Binks unit which had been in use for 23 years and was still operating perfectly when dismantled to make room for the new tower.

Two factors influenced the choice of another Binks tower . . . outstanding performance of the first two units and lower first cost of the new tower. Because Binks equipment is of modular design it is highly flexible. Expensive custom work or modifications were not necessary.

Free Specification Data

In 9 cases out of 10 a standard Binks cooling tower will meet your requirements exactly at a substantial saving. Write for mechanical and performance specifications.

0853

Binks

EVERYTHING FOR WATER COOLING

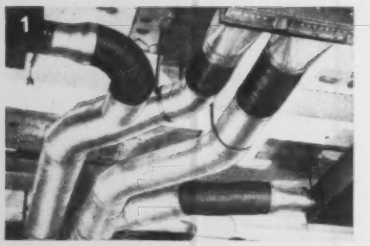
A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

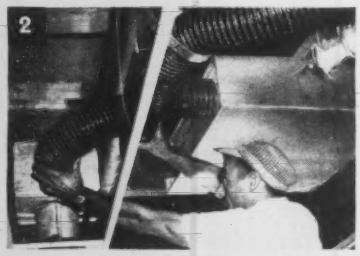
Binks Manufacturing Company

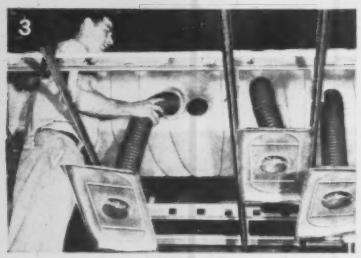
3144-A Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

which system is HIGH VELOCITY? MEDIUM VELOCITY? LOW VELOCITY?







ALL THREE USE WIREMOLD® AIR DUCT

Rugged and flexible, Wiremold Air Duct is being used today wherever air conditioning systems are employed. Send for latest literature. Answer: (1) medium (2) high (3) low.

4-1C
WIREMOLD ■ HARTFORD 10, CONN.
Send latest literature.

NAME

COMPANY

ADDRESS

THE WIREMOLD COMPANY • HARTFORD 10, CONN.

EQUIPMENT DEVELOPMENTS

Continued

Electronic Air Cleaner Has Activated Charcoal Filter

Unit cleans, deodorizes, and recirculates air in room up to 5000 cu ft for use in restaurants, laboratories, and hospitals. Available in portable plug-in floor model or suspended ceiling model. Maintains 90 percent efficiency standard of the NBA "Dust Spot Test." — *Electro-air Cleaner Co., Inc., Olivia and Sproul Sts., Dept. CR, McKees Rocks, Pa.*

Welding Torch for All Inert Gas Welding

Torch for plug and spot, spray arc, and short arc welding. 500 amp unit of in-line design has all service lines (gas, power, water, and wire) entering through rear of barrel. "ST-5" has adjustable and removable aluminum alloy pistol-grip handle with large trigger. — *Linde Co., Div. of Union Carbide Corp., Electric Welding Dept., 270 Park Ave., New York 17.*

Remote Control for Mechanical Speed Changers

Mechanical remote control for changing output speeds of firm's variable speed motor drives. Unit consists of a flexible shaft and an indicator handwheel. Flexible shaft of anti-backlash construction; standard length 5 ft with other lengths available. Units for use on "Motodrives" rated 1/4 through 2 hp. — *Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17.*

Babbitt

Adjustable
SPROCKET RIM
with Chain Guide
Changes that Danger Zone to a SAFETY ZONE

—enables you to ADD PLANT AREA

If re-aligning equipment will yield more working space, better production, lower costs—do it now. Save all space wasted for placing ladders to reach overhead valves. At the same time, convert Danger Zones to Safety Zones. Equip every overhead valve wheel in your plant with Babbitt Adjustable Sprocket Rims with Chain Guides.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
- They operate any valve from the floor.
- They save time and money.
- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. Just phone your mill supply salesman or contact us direct.

Babbitt 168-B

STEAM SPECIALTY CO.

8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

EQUIPMENT DEVELOPMENTS

Continued

A-C, D-C Welder Has Continuous Current Control

Unit available in 300, 400, and 500 amp sizes. Has continuous current control and straight or reverse d-c polarity. Open circuit of 80 v in both a-c and d-c, and two welding currents in each. Features semi-metallic rectifier, forced draft ventilation, dead front construction, and drip-proof cabinet. — *Miller Electric Manufacturing Co., Appleton, Wis.*

Motorized Damper Operator Mounts Directly on Shaft

Unit applied to secondary air service and mounts directly on damper shaft. Plug-in electrical connections standard. Housing waterproof. Full 90 deg stroke requires 45 sec, accomplished by a positive motor-driven torque of 850 in.-lb. Motor supplied with brake to prevent coast. Operates on 115 v, 60 cycle power supply. — *Automatic Timing & Controls, Inc., King of Prussia, Pa.*

Paint Withstands Up To 1700 F Temperatures

Paint with silicone base and aluminum pigment withstands temperatures up to 1700 F without blistering or burning. Dries in approximately 30 min forming a metal coating resistant to moisture, corrosion, mild acids, alkalis, and industrial fumes. Available in 10 colors. Can be applied by brush, spray, or dip. — *Chem Industrial Co., 3784 Ridge Rd., Brooklyn 9.*

Here a drain elbow and a reducer form the "bodies" for DURABLA *Basic-Check* Units. As indicated, they will operate in any position . . . can be used with most standard fittings.

Put this check valve ANYWHERE in existing piping

The DURABLA *Basic-Check* Unit* is the most convenient check valve you can use, since it installs in existing piping anywhere you please. Combined with almost any standard fitting—like the drain elbow or reducer shown—it becomes a complete check valve suitable for the widest variety of services.

It operates freely in any position. Thus it can be installed without changes in existing lines, or costly "positioning" in new installations. Means cleaner designs, too, because there are no demands on space.

These stainless-steel valve units will handle practically any liquid, gas or air . . . come in seven standard line sizes from ⅜" to 2".

For full details, send for booklet HPA 41.

DURABLA MANUFACTURING CO.
114 Liberty Street, New York 6, New York

DURABLA®

Manufacturers of DURABLA sheet packing, gaskets and pump valves.

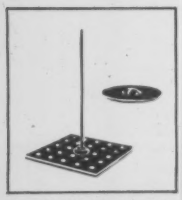
*The DURABLA *Basic-Check*® Brand Unit is covered by U. S. Patent No. 2,649,277 and Canadian Patent No. 549,618.

DM-42

INSULATION INSTALLED FAST

WITH MIRACLE SURFACE ANCHORS

Use Miracle Surface Anchors, bonded with Miracle Anchor Adhesives, to provide firm support for block, board, or blanket type insulation. Eliminates drilling and welding. You save man hours, cut costs way down.



Use Spindle Anchors for bonding fibrous glass batts, mineral wool to ducts, walls, ceilings. Lock washer holds insulation firmly in place.

Use Pronged Anchors for bonding block insulation such as cellular glass. Pronged Anchors are set between rows of blocks and then prongs are bent over.

FREE

Valuable, informative engineers and architects bulletins giving details and complete specification data. Yours on request.

MIRACLE SURFACE ANCHORS

are manufactured by

DEVICES • Division of **MIRACLE ADHESIVES CORP.**

250 Pettit Avenue
Bellmore, Long Island, New York

EQUIPMENT DEVELOPMENTS

Continued

Gas-Fired Air Conditioner Available in 3½ Ton Unit

Gas-fired downflow year around air conditioner has 3½ ton cooling and 120,000 Btu per hr input heating capacities. Blower rated at 1400 cfm, cooling cycle. Motor rated 115 v, 60 cycle, single phase, ½ hp. Unit includes two 16 × 25 × 1 in. filters. Other units of various types available, or will be available soon. Literature sent on request. — *Arkla Air Conditioning Corp., Shannon Building, Little Rock, Ark.*

Sleeve Pillow Block Operates On Hydrodynamic Oil Film

Sleeve pillow block bearing surfaces are integral parts of assembly; operate with unground shafting. Features closed recirculatory oiling system. Unit resistant to moisture and dust; will not leak. For handling loads in range of 50 psi at 1750 rpm; can handle moderate thrust loads. — *Tann Corp., Congress Drives Div., 3750 E. Outer Dr., Detroit 34.*

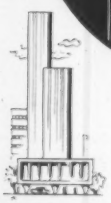
Tinted Window Coating Reduces Heat Gain

Permanent transparent coating applied to windows reduces up to 89 percent radiant heat transmission; eliminates up to 100 percent of ultraviolet rays. Available in several colors including frosted and clear shades. Will not chip, peel, or crack. Bulletin sent on request. — *Sun-Check Co., 166 Saratoga Ave., Los Gatos, Calif.*

Sterlco®

THERMOTROL

ACCURATE, INDIVIDUAL ROOM TEMPERATURE CONTROL . . . FOR STEAM OR HOT WATER SYSTEMS



Schools, Offices and Apartments

Institutions, Hospitals and Public Buildings

EVEN HEAT

Controls each unit of radiation independently . . . provides heat only when temperature in room or small area falls below Thermotrol setting. Eliminates thermostats and zone valves.

SAVES FUEL

Thermotrol installations often pay for themselves in fuel savings. Prevents overheating and waste of fuel. Excellent for correcting unbalanced systems. Heat used only when and where it is needed.

EASILY INSTALLED

Completely self-contained . . . requires no connection to power supply, or external control device. As easy to install as ordinary radiator valves.

Leaders since 1916

Sterling inc.

5202 W. Clinton Ave., Milw. 23, Wis.

EQUIPMENT DEVELOPMENTS

Continued

Reference Voltage Source For Indicating Controllers

Model "350" for use with null-seeking galvanometer type indicating controllers of firm's "400" series. Combination is a measuring system for control applications requiring minimum time lags of 5 percent or less proportioning band. Three-digit dial provides adjustment of set point. Unit incorporates a Zener Diode stabilized source. Over-all measurement sensitivity 0.25 F; better with base-metal thermocouples. Unit flush mounted. — *Barber-Colman Co., 1701 Rock St., Rockford, Ill.*

Electric Portable Heater Has Built-In Thermostat

Forced-air unit contains enclosed heating element. Built-in thermostat provides automatic operation and control. Weighs 9¼ lb. Operates on 120 v at 1500 w. Bulletin M70101 sent on request. — *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8.*

Air Conditioner Combines Condensing, Evaporative Units

Packaged air conditioner combines air cooled condenser and evaporative air cooler. Pre-cooled air (25 to 30 F below ambient temperature) from the evaporative air cooler is fed directly into condensing unit, allowing condenser to operate at lower head temperatures. Unit available in 2 and 3 ton sizes. — *Gaffers & Sattler, 8111 W. Beverly Blvd., Los Angeles 48.*

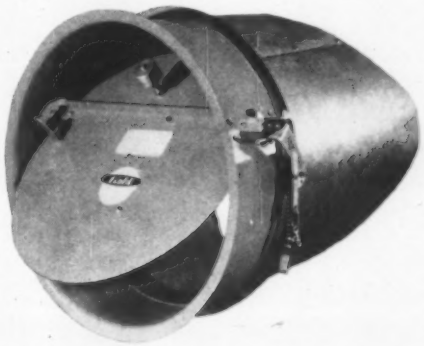
Don't design a

DRAFT SHORTAGE

into your

GAS BOILER

installations



Specify a double-acting

field

DRAFT CONTROL*

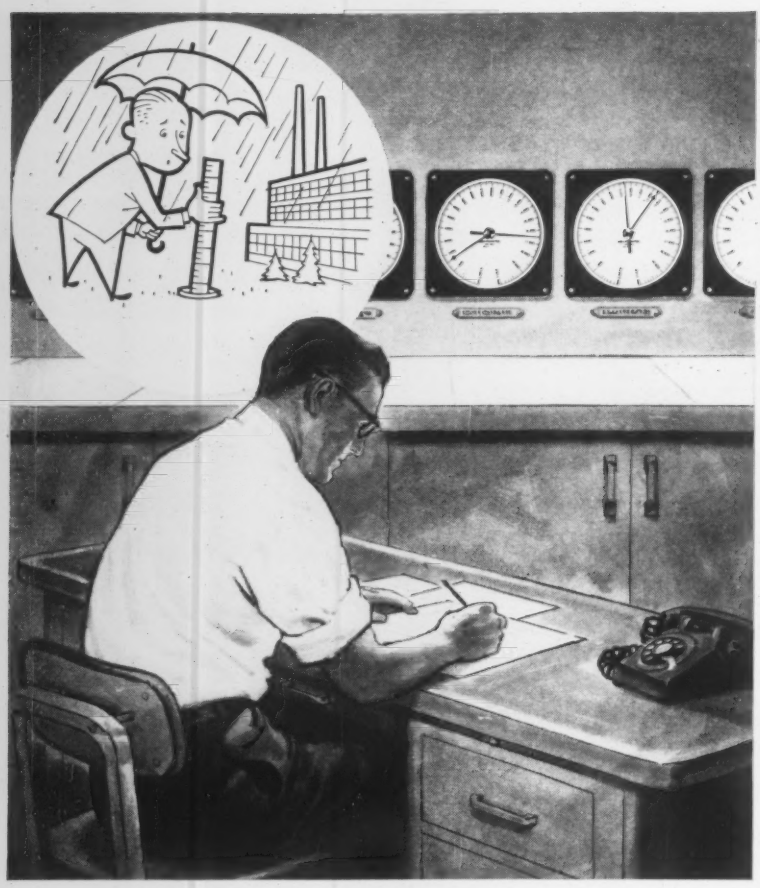
*With a Field the draft assistance of the chimney becomes available to the boiler for abundant draft at all firing rates, precisely controlled to the optimum twelve-to-one air-to-gas ratio recommended for clean, bright, efficient combustion. For 5" through 34" flue outlets. Write for specification data.

Specify Field Draft Controls for gas, gas-oil, oil or coal, for boilers, furnaces, incinerators, with natural, forced or induced draft, 5" through 34" flues.

FIELD CONTROL DIVISION

Conco Engineering Works, Inc., Mendota, Illinois

AFFILIATES: Spartan Tool Division — Powered Sewer Cleaning Equipment
Materials Handling Division — Cranes, Hoists
Conco Building Products, Inc. — Brick, Tile, Stone



Take the legwork out of liquid measurement

Here's practical liquid measuring—the modern way . . . without roaming all over the lot! Liquidometer Gauges let you inventory distantly stored liquids at a glance.

Completely automatic Liquidometer Gauges can be located as far as 250 feet from tanks. Think what this centralized system can mean in man-hours saved—let alone the additional safety of personnel who no longer have to trudge to, or tamper with, hard-to-get-at tanks.

Simple to install, and requiring no maintenance, Liquidometer Gauges measure virtually all liquids conveniently, continuously, and correctly. There's a type available for practically every liquid measuring application.

For complete details, write

LIQUIDOMETER INSTRUMENTS

THE LIQUIDOMETER CORP.

Dept. A, LONG ISLAND CITY 1, NEW YORK

EQUIPMENT DEVELOPMENTS

Continued

Tube Fittings Available In Special Shapes and Sizes

Tube fittings in various shapes, sizes, finishes, and materials: crosses, tees, elbows, unions, elbow unions, connectors, and lateral elbows. Units have O-ring seal. Available in cadmium plated steel, black phosphate, stainless steel, or other materials. Literature sent on request. — *The Lenz Co., 3301 Klepinger Rd., Dayton 1, O.*

Ball Valves Available in 1/4 to 2 In. Diameters

Bar stock, bi-directional ball valves have two "Teflon" seats to seal flow in both directions. Rated at 600 wog with 1000 psi test. Available in carbon steel, 303 and 316 stainless steel, and brass. Valves have self-lapping and self-cleaning action, quarter-turn operation, and visible on-off indication. — *Hydromatics, Inc., 5 Lawrence St., Bloomfield, N.J.*

Steam Traps Have Integral Strainer

Bellows thermostatic steam traps have integral strainer. Unit permits two changes of flow direction to reduce effect on any shock loading. Includes connection for blowdown of strainer. Trap strainer in monel; bellows in bronze or monel. Trap suitable for steam pressures from 0 to 250 psi, temperatures to 450 F. — *Clark Manufacturing Co., 1836 E. 38th St., Cleveland.*

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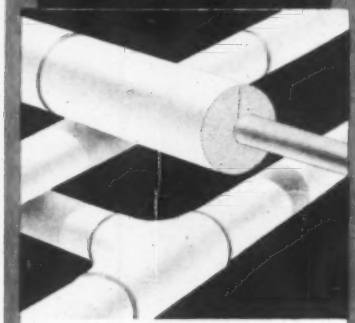
New CLAIR COAT
LAGGING ADHESIVE
CREATED FOR THE TOUGHEST PIPE AND DUCT LAGGING APPLICATIONS.
A NEW AND EXCLUSIVE PRODUCT OF ST. CLAIR'S RESEARCH LABORATORIES.



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- **FAST SETTING** Sets almost immediately for faster application.
- **LOW FREEZING POINT** and is usable after being frozen solid.
- **NON-FLAMMABLE** with fire retardant dried film
- **STRONGEST PERMANENT BOND** Proved by comparative tests.
- **ONE COAT NEEDED** for sleek, semi-gloss finish
- **STEAM AND WATERPROOF** by contractor's tests
- **VERMIN-PROOF**
- **FINE APPEARANCE** with long-lasting protection
- **EASILY WASHABLE**
- **NON-TOXIC** and will not settle in container

Write for literature - samples - prices.

ST. CLAIR RUBBER CO.
Empire Bldg.
107 Clifford St. Detroit 26, Mich.

RECENT TRADE LITERATURE . . .

▸ *ADHESIVES, COATINGS, AND SEALERS*—54 page catalog lists official U.S. Government specifications for many adhesives, coatings, and sealers. Lists in numerical form, military specifications, specification definitions, intended application, and firm's product to meet these specifications. — *Minnesota Mining & Manufacturing Co., 900 Bush Ave., St. Paul, Minn.*

▸ *AIR CONDITIONER, CENTRAL STATION*—Bulletin 94A-1 describes unit with integral air-cooled condenser. Available in 30 to 60 ton capacities. Can be furnished in two sections for remote location of condenser. *U.S. Air Conditioning Corp., P.O. Box 360, Delaware, O.*

▸ *AIR CONDITIONERS, REMOTE*—20 page catalog describes firm's type "F" units. Line consists of free standing, recessed, overhead, and recessed overhead models. *Fedders Corp., Heating Div., Lalor & Hancock St., Trenton 7, N.J.*

▸ *AIR CONDITIONING, AIR HANDLING, HEAT TRANSFER, AND FLUID DRIVE EQUIPMENT*—20 page Brochure B-6429 "Profile" discusses application of equipment in buildings, industrial plants, and industrial processes. Firm's line of equipment briefly described and illustrated. *American-Standard Industrial Div., Detroit 32, Mich.*

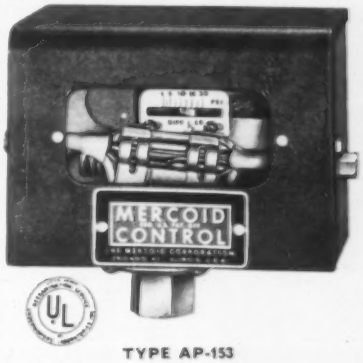
▸ *AIR CONDITIONING SERVICE MANUAL*—booklet outlines mechanical components of common air conditioning systems. Includes wiring diagrams and a relative humidity chart. Covers heating cycle and various components involved. Gives service procedures. Make request on company letterhead. *Pioneer Manufacturing Co., 3131 San Fernando Rd., Los Angeles 65.*

Small, Lightweight

MERCOID PRESSURE CONTROL for Instrument Air

Exclusive Features

EXTERNAL ADJUSTMENT
VISIBLE CALIBRATED DIAL
VISIBLE SWITCH POSITION
FOR PANEL OR PIPE MOUNTING
SEALED MERCURY CONTACT



TYPE AP-153

ADJUSTABLE OPERATING RANGE	SWITCH DIFFERENTIAL With Pointer Set At	
	LOW	HIGH
1 to 20 psig.	0.3	0.5
1 to 30 psig.	0.4	0.75

Provides any of following operations:

1. *Single Pole—Cut-in high (close on rise)*
2. *Single Pole—Cut-in low (open on rise)*
3. *Single Pole—Double Throw*

OTHER TYPES AVAILABLE

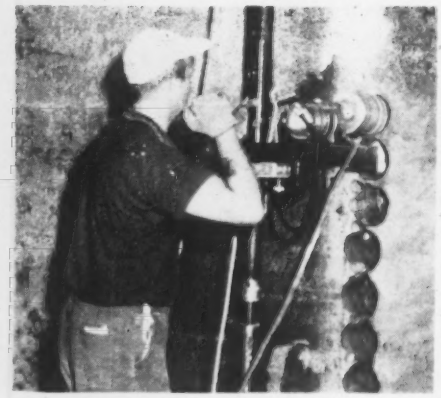
CASE: NEMA 1—Heavy gauge steel, cadmium plated. Steel cover (with glass front).

WRITE FOR BULLETIN 02

THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.

CUTTING POWER!

Holes From Floor to Ceiling With One Setup of Longyear "330" Drill!



For more facts on application of Longyear drills and diamond bits, write Department 58.

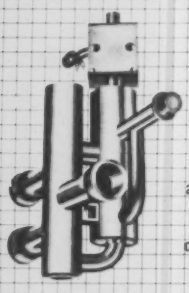
A midwest contractor had to make two 6 x 7 foot openings through a 13-inch thick concrete wall. Their air hammer stopped every time it hit reinforcing. Finally they tried a Longyear "330" drill and 6-inch diamond bits. With one setup of the "330" they cut a line of holes from floor to ceiling, $\frac{3}{4}$-inch reinforcing and all! No scaffolding needed.

Longyear®

E. J. LONGYEAR CO.
76 S. Eighth Street, Minneapolis 2, Minnesota
Phone: FEderal 9-7631

ADV 1758

PRESENTING THE QUALITY LINE OF AUTO CONTROLS



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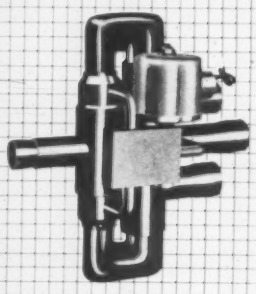
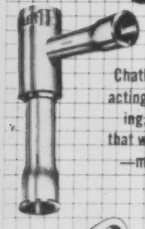
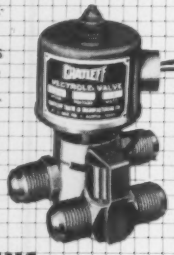
Chatleff is a pioneer in the field of reversing valves. Chatleff valves are constructed of dense uniform brass with Teflon seating; hermetically sealed for immediate, quiet, dependable performance



CHECK VALVES



Chatleff Checks are instant-acting, silent, non-chattering, high-pressure checks that will seal at low pressure —minimum pressure drop.



THE
VECTROLE
SYSTEM

The Chatleff Vectrole system, consisting of the Vectrole Valve, Switching Element and Thermostat, provides independent unit control for hot or chilled water systems at a reasonable price.

For complete information, write:

Chatleff CONTROLS INC
205 INDUSTRIAL BLVD. • AUSTIN, TEXAS

RECENT TRADE LITERATURE
Continued

▸ *AIR CONDITIONING SYSTEMS*—booklet gives installation data for heating and cooling perimeter systems. Shows how to calculate "U" factor. Data given on sizing heating and cooling equipment. Illustrated with charts and tables. Various formulas given. *Pioneer Manufacturing Co., 3131 San Fernando Rd., Los Angeles 65.*

▸ *AIR DISTRIBUTION EQUIPMENT*—eight page condensed catalog, F-1171-8, describes equipment used in air distribution systems. Various designs, sizes, finishes, and applications given. Includes information on continuous line extruded aluminum ceiling diffusers and modifications to continuous line diffusers with "Uni-Flo" core. *Barber-Colman Co., 1300 Rock St., Rockford, Ill.*

▸ *CASTINGS AND FORGINGS, COLD REPAIR SYSTEM FOR*—file folder type catalog describes system for repairing broken and cracked castings and forgings. Applications include compressors and cylinders, blowers, shafts, and other products. System restores compressive and tensile strengths to damaged part. Eliminates residual stresses; restores dimensional accuracy and rigidity without decreasing load resistance. Repairs can be made on location. *Metalock International, Inc., 36-15 48th Ave., L.I. City 1, N.Y.*

▸ *CURB, ROOF EXHAUST FAN*—four page Bulletin No. TA-101 describes all-aluminum thermal-acoustic curb. Explains advantages, gives dimensions schedule, typical specification, and a cut-a-way diagram with legend. *Davidson Fan Co., Dept. 14-A, 213 California St., Newton 58, Mass.*

▸ *DRAINLINE, CHEMICAL WASTES*—16 page revised and expanded Bulletin PE-30 describes corrosion-resistant glass system for dis-

RECENT TRADE LITERATURE

Continued

posal of chemical wastes. Contains product property data. Gives details on available fittings. Illustrated with photos, schematic drawings, and charts. Sample specification sheet included. *Corning Glass Works, Plant Equipment Dept., Corning, N.Y.*

▸ *DUCT, AIR, ASBESTOS-CEMENT*—four page folder includes data on asbestos-cement air duct for heating, cooling, and ventilating. Gives characteristics and specifications. Illustrated with drawings. *Keasbey & Mattison Co., Butler Ave., Ambler, Pa.*

▸ *ENVELOPES, PLASTIC BLUEPRINT PROTECTING*—two page Bulletin 809 describes plastic envelopes for permanent protection of blueprints, charts, diagrams, job progress forms, etc. Envelope has clear vinyl window on front and back to allow visibility from both sides. *Seton Name Plate Co., Inc., 50 Fitch St., New Haven 15, Conn.*

▸ *FASTENERS*—four page brochure in chart form gives selection data, fastener types, drill sizes, where to use, sizes available, and holding strengths. Includes information on firm's line of masonry drills. *Diamond Expansion Bolt Co., Inc., Dept. S, North Ave., Garwood, N.J.*

▸ *FILTERS, STRAINERS, DRIERS*—four page Bulletin D6 describes complete line of flanged demountable shells with replaceable, interchangeable filter-drier, filter and strainer cartridges for permanent liquid line service on air conditioning and refrigeration systems. Shells of all-brass construction; filter-drier cartridges have all-brass casings. Selection chart shows dimensions, water capacities, drying capacities, and tonnage ratings for sizes of 1 to 100 ton capacity systems. *The McIntire Co., Okner Parkway, P.O. Box 5, Livingston, N.J.*

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in Detroit's Beautiful City-County Building

Since the installation of the Cambridge AEROSOLVE® 85 filters – which *do* remove the invisible, smudge-producing particles – the 504,000 c.f.m. of air circulating through the City-County Building is *really clean*. Equipped with prefilters, the 280 cartridges in this AEROSOLVE filter bank have a service life of more than a year.

Combine Filter Efficiency with Filter Economy on Your Next Job

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Here's where the "haloes" are trapped. Note how easily AEROSOLVE cartridges are replaced.

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Low Maintenance
Long, Long Service

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Available in Gravity or Vacuum Types.

Accurate to within 1% from zero to rated capacity regardless of system pressure.

CADILLAC Meters are used by:

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▶ *FLOW METERING ELEMENTS*—eight page Bulletin No. 100.20.1 describes line of primary flow metering elements for water, air or gas, petroleum, alkalies, and acids. Suitable for high pressure and temperature services. Includes Venturi flow tubes, Hershel standard, long, and short forms; Venturi flow nozzles, welded insert, flanged insert, and single tap; Dall flow tubes, cast metal and weldment; Dall flow tube plastic insert; and plastic Parshall flume liners. Gives specifications, applications, and advantages of each element. Illustrated with photos. *B-I-F Industries, P.O. Box 276, Providence, R.I.*

▶ *GRILLES, ALUMINUM*—32 page bulletin describes supply, return, and filter grilles. Gives data on design, selection, and material of units. Illustrated with diagrams, photos, dimension drawings, and tables. *Metal Industries, Inc., North Hercules Ave., P.O. Box 449, Clearwater, Fla.*

▶ *HEATERS, UNIT, CHECKLIST FOR MALFUNCTION OF*—23 × 21 in. wall chart gives checklist and maintenance suggestions for unit heaters. Includes information for 1. When heater fails to maintain desired temperature; 2. Unit blows cold air; 3. Unit doesn't operate when heat is needed; 4. Heat doesn't reach floor level; 5. Noisy unit; 6. Unit leaks; 7. Hot blasts on workers; 8. Operating cycle too long; and 9. Motor failures. *Modine Manufacturing Co., 1500 DeKoven Ave., Racine, Wis.*

▶ *HEATERS, UNIT, INDUSTRIAL, OIL-GAS*—12 page bulletin describes "OG4" rated at 280,000 to 1,000,000 Btu per hr. Gives application photos and blower performance charts. Tables provide dimensional data, air

For the Savannah Plant of SOUTHERN NITROGEN CO.

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Handling hot potassium carbonate requires safeguarding pumps and piping systems against dangerous pressure surges. Eight Williams-Hager Silent Check Valves—similar to the one shown at right—guard Southern Nitrogen's Savannah Plant by operating *instantly* when flow reversal starts or when flow is zero.

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RECENT TRADE LITERATURE

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handling capacities, heat exchanger area, motor hp, and additive cooling capacities. Diagrams show various arrangements possible when auxiliary equipment is added. *Lennox Industries Inc., 200 S. 12th Ave., Marshalltown, Ia.*

▸ *HEATERS, UNIT, INFRARED ELECTRIC*—catalog describes radiant panel heaters using "Pyrex" glass panels and radiant tube heaters using "Vycor" tubes. Units may be mounted on wall or ceiling. Tube type also available in portable model. *Sun-Heat, Inc., 998 E. Woodbridge, Detroit 7.*

▸ *HEATERS, WATER, GAS AND ELECTRIC*—24 page manual "Domestic and Commerical Automatic Gas and Electric Water Heaters" gives performance and specification data and sizing information. Includes examples of various installations. Covers gas pressure regulation, piping, combustion and ventilation air, venting, common complaints, and service data. Make request on company letterhead. *Pioneer Manufacturing Co., 3131 San Francisco Rd., Los Angeles 65.*

▸ *HEAT EXCHANGERS, CLEANING OF*—four page bulletin recommends cleaning procedures for heat exchangers and similar equipment using sulfamic acid. Eight page bulletin gives calcium carbonate scale dissolution rates for dry acid cleaners based on firm's sulfamic acid. *E. I. du Pont de Nemours & Co., Inc., 4147 Du Pont Building, Wilmington 98, Delaware.*

▸ *HEATING EQUIPMENT; ELECTRIC COMFORT*—16 page Catalog 975-D gives application and product information for electric comfort heating equipment. Each item covered with explanatory copy, illustrations,

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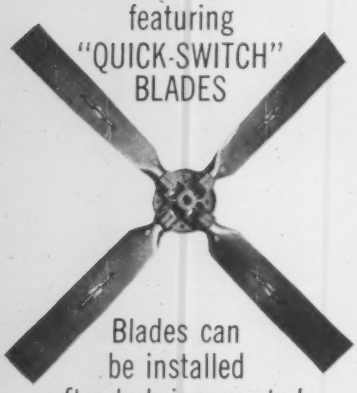

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dimensions, engineering and application data. Includes baseboard heaters; forced air wall insert heaters; radiant heaters; floor drop-in types; cabinet convectors; snow melting mats, unit ventilators; console unit heaters; industrial blower units; spot heaters; duct heaters; and many types of controls. *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8.*

▸ *HEATING INSTALLATIONS, INDUSTRIAL*—Pamphlet CH-110 gives ideas on industrial heating installations. Gives sizing data and installation instructions. *A. O. Smith Corp., Permaglas Div., Kankakee, Ill.*

▸ *HEAT LOSS CALCULATION*—guide gives instructions for determining room-by-room heat loss, boiler size, and radiation selection. Methods based on IBR information. Includes typical example, several tables, and a heat loss calculation sheet (which are also available). Tables include: heat loss factors for walls, ceilings, floors, and infiltration; heat losses in Btu per hr based on 70 F temperature difference; and conversion factors to determine heat loss for any temperature difference from 20 to 110 F. *Crane Co., P.O. Box 780, Johnstown, Pa.*

▸ *HOSE ASSEMBLY COMBINATIONS*—four page reference Bulletin IEB-53 covers various categories of end fittings for low, medium, and high pressure hose assemblies. Includes "Teflon" hose assemblies. Illustrated with tables. *Aeroquip Corp., 300 S. East Ave., Jackson, Mich.*

▸ *ICE SKATING RINKS, STEEL PIPE IN*—12 page booklet gives a brief history of ice skating, followed by information of how to install an ice skating rink using steel pipe. Ad-

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RECENT TRADE LITERATURE

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vantages of steel pipe included. Thumbnail sketches and short descriptions of rink's location, site selection, planning, financing, construction, and use given. Illustrated with photos and line drawings. *Committee of Steel Pipe Producers, 150 E. 42nd St., New York 17.*

▸ *INDICATOR, COMBUSTION*—eight page Bulletin Q-2 describes continuous reading unit. Indicates changes in flame characteristics caused by variations in air-gas mixture. Detects changes as little as ±5 Btu in fuel gas and ±0.5 percent of air in air-gas mixture. Applications, specifications, and operational data given. Includes performance curves, schematic diagram, and an internal photo with nomenclature listed. *Selas Corp. of America, Dresher, Pa.*

▸ *INSULATION, THERMAL*—64 page Catalog IN-244A describes thermal insulation for all types of commercial and industrial requirements in applications ranging from −400 to 3000 F. Includes individual sections on industrial and high temperatures; air conditioning and heating; insulating firebrick and refractories; and other applications. Data on each product consists of application photo; description; available forms or types; specification data; and government and ASTM standards. *Johns-Manville Corp., 22 E. 40th St., New York 16, N.Y.*

▸ *INSULATION, UNDERGROUND PIPE*—four page bulletin describes firm's "All-Weather Crete U.P.-20" insulation for underground pipe. Includes installation instructions, physical properties, a pipe size chart, a "C" factor chart, and specifications. Material is a thermo-setting monolithic conduit; does not require curing. Contains no water; has high water resistance. Impervious to common acids. Thermal conductivity 0.44 Btu per hr per sq ft F per in. at 75 F. *Silbrico Corp., 5901 W. 66th St., Chicago 38.*

▸ *MATERIALS FOR ADVANCED TECHNOLOGY*—eight page bulletin describes 12 new products resistant to abrasion, chemicals, corrosion, nuclear radiation, and high temperature. *The Carborundum Co., P.O. Box 337, Niagara Falls, N.Y.*

▸ *METAL FORMING MACHINES*—32 page Catalog No. 61 describes complete line of firm's metal forming equipment. Benders, press brakes, shears, notchers, rollers, and other equipment listed. Pictorial index aids selection. Specifications, applications, and accessories given. Illustrated with photos, diagrams, and tables. *Di-Acro Corp., 10 Jefferson Ave., Lake City, Minn.*

▸ *MOTORS*—four bulletins discuss various types of motors. Four page

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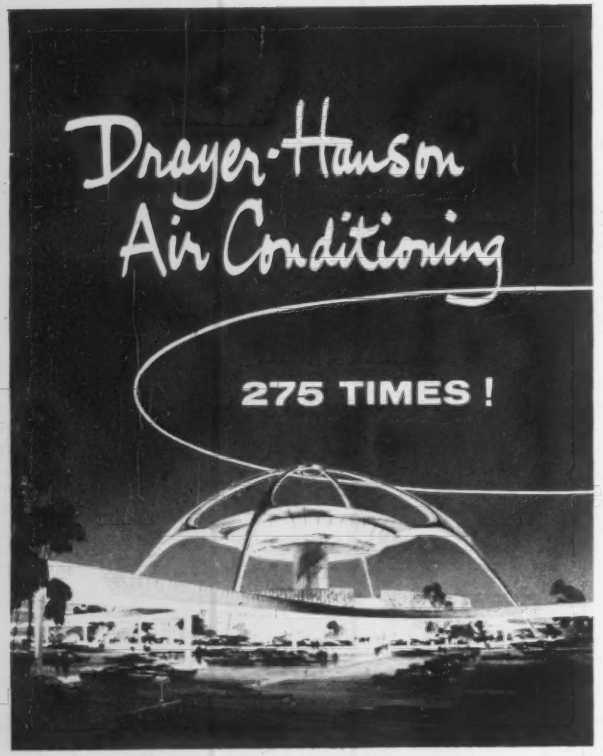
MC-44



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(Cable: Cliconi, Los Angeles)

RECENT TRADE LITERATURE

Continued

Bulletin 1455 covers close coupled pump motors, both polyphase and single phase. Includes data on extended and standard keyed shafts. Two page Bulletin 1465 describes firm's part-winding starting motors, types "SC," "SCH," and "SCK." Speed-torque characteristics plotted on graph. Includes diagram of connections. Two page Bulletin 1430 describes D-flange motors from 1 to 150 hp. Includes application data and tolerances. Four page Bulletin 1300 covers multi-speed motors. Discusses variable-torque, constant-torque, and constant-horsepower motors, both polyphase and single phase. *Century Electric Co., 18th & Pine Sts., St. Louis 3.*

▸ *MOTORS, EXHAUST FAN*—two page Bulletin No. AS-101 describes advantages of placing roof exhaust fan motors in the air flow. Illustrated with cut-a-way diagram and photo. *Davidson Fan Co., Dept. 14-B, 213 California St., Newton 58, Mass.*

▸ *MOTORS, VERTICAL*—two page Bulletin 1485 gives application and technical data for integral hp units. Includes condensed dimension table. Illustrated with photos and line drawings. *Century Electric Co., 18th & Pine Sts., St. Louis 3.*

▸ *PIPE, CAMERA FOR VIEWING INSIDE OF*—two page Bulletin PD-700 gives specifications for closed-circuit television camera for exploring pipe as small as 4 in. in diameter. Unit watertight to a depth of 10 ft and 5 psi. Has built-in light source and a removable mirror for axial or radial viewing. Typical applications include: locating unmapped connections; inspecting pipe for corrosion holes; examining valves to determine if they are partially open or closed; determining pressure of liquid in main; locating obstructions; and inspecting sealing operations on cast iron mains. *General Precision, Inc., GPL Div., 63 Bedford Rd., Pleasantville, N.Y.*

▸ *PIPE, INDUSTRIAL WATER, ASBESTOS-CEMENT*—10 page Brochure TR-254A gives data on design and specification of industrial water systems. Includes data on materials and installation. Applications include water supply mains, distribution lines, service water, process water, potable water, and cooling water supply and return lines. Performance characteristics for "Transite" pipe given. Data on flow characteristics, friction loss, pipe strength in hydrostatic, flexural, and crushing tests included. *Johns-Manville Corp., 22 E. 40th St., New York 16.*

▸ *PIPE, PLASTIC*—four page Brochure TR-273A describes firm's acrylonitrile-butadiene-styrene plastic pipe. Contains tabular data on physical properties, rated working pressures, sizes, and weights. Illustrations

RECENT TRADE LITERATURE

Continued

of various applications included. Gives recommended method of joining pipe, including field procedures. 10 page Brochure TR-270A describes firm's polyethylene pipe. Gives product characteristics and performance data. Includes recommended practices for cutting, connecting, installing, testing, and backfilling. Illustrated with photos, table of properties, and flow chart. *Johns-Manville Corp., 22 E. 40th St., New York* 16.

▸ *PIPE, TUBING, AND HOSE, HOW TO MEASURE AND RELATE SIZES OF*—16 page Bulletin No. 631 gives standard methods of measurements, discussing similarities and differences in measuring various fittings and fluid-carrying lines. Explains standard practices of measuring adapters and complete assemblies. Dash numbering systems commonly used in pipe and tubing measurements explained in chart form. *Aeroquip Corp., 300 S. East Ave., Jackson, Mich.*

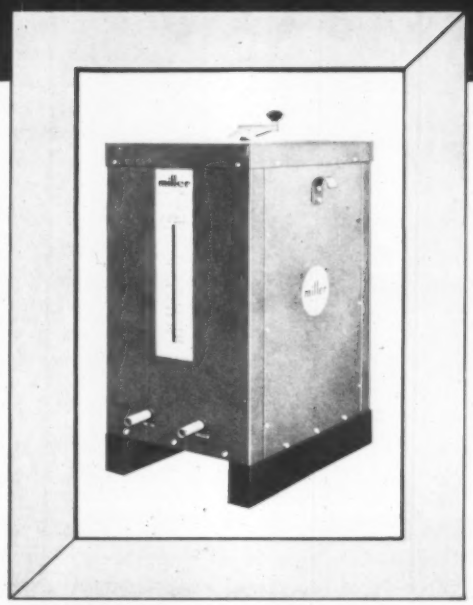
▸ *PIPING DESIGN MODELS*—four page bulletin explains the whys and hows of using scale models as an engineering tool in designing and constructing new plants. Outlines procedure from preliminary stage through construction. *Industrial Models, Inc., 2311 Sconset Rd., Wilmington 3, Del.*

▸ *PLASTICS*—192 page catalog covers over 800 different items on plastic sheets, rods, tubes, etc. Plastics include "Delrin," "Lexan," polyester, polypropylene, "Penton," and others. *Industrial Safety Supply Co., Inc., Industrial Plastic Supply Div., 574 New Park Ave., West Hartford 10, Conn.*

▸ *PLASTIC, ACETAL COPOLYMER*—four page technical Bulletin NP-44 describes firm's "Celcon." Gives information on impact, creep, friction and abrasion, and chemical resistances. Various properties are outlined. Characteristics such as molding conditions, extrusion, finishing, and machining explained. Illustrated with diagrams. *Celanese Corp. of America, Celanese Polymer Div., 180 Madison Ave., New York* 16.

▸ *PLASTICS, INDUSTRIAL, COMPARISON OF*—12 page chart brochure compares properties of nine industrial plastics with firm's plastic. Compares cost, heat deflection at 264 psi, impact strength at room temperature, impact at low temperature, tensile modulus or rigidity, and hardness. Plastics include "Cycolac GS," nylon, acetal resin, cellulose acetate butyrate, cellulose acetate, modified acrylic, polypropolene, linear polyethylene, and high-impact styrene. *Borg-Warner Corp., Marbon Chemical Div., Dept. C-2, P.O. Box 68, Washington, W. Va.*

MEET THE MILLER A-C "S" SERIES



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Low first cost teams up with maintenance-free reliability to make the "S" very big on value.

Yet everything needed for top performance is here, including movable coil design, silicon steel cores, class B insulated copper coils, superior cooling, and 80 volts open circuit for instantaneous arc starting. Case is heavy gauge steel under baked enamel lifetime finish with dead front construction.

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* **FIBROUS MATERIAL**

AIR-MAZE LINT-A-MAZE FILTERS are specially designed to provide 98% or more efficiency in removing heavy concentrations of lint, chaff, leather cuttings and similar materials from the air. Brushes mounted on a chain carrier continually sweep and automatically clean the collector screens. Collected material is deposited in a hopper for reprocessing or sale. Lint-A-Maze filters offer these important advantages:

- Low initial cost . . . low operating cost
- Require less than 50% of the space normally needed
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- Can be installed in any recirculating air opening, ventilating or air-conditioning system
- Available for airflow requirements from 7,000 to 150,000 CFM, can handle air velocities from 250 to 1900 FPM.

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CLEVELAND 28, OHIO

ROCKWELL R STANDARD

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RECENT TRADE LITERATURE

(Continued)

▸ *POLYSTYRENE, EXPANDED AND EXPANDABLE*—eight page booklet describes "Uni-Crest" expandable and expanded polystyrene for air conditioning parts and other applications. Discusses pre-expansion and molding of material. *United Cork Co., 120 Central Ave., Kearny, N.J.*

▸ *PUMPS, CENTRIFUGAL*—two page Bulletin 1052-1 gives design features and model specifications of Models "C" and "CW" canned pumps. Units for pumping corrosive, toxic, radioactive, and other problem fluids. Illustrated with graphs and photos. *Fostoria Corp., Chempump Div., Huntington Valley, Pa.*

▸ *PUMPS, CENTRIFUGAL, DOUBLE BALL BEARING END SUCTION*—four page Bulletin 3913 describes 1 to 3 in. models. Illustrated with performance tables, dimension prints, and photos. *The Deming Co., 14 Aetna St., Salem, O.*

▸ *PUMPS, REGENERATIVE CENTRIFUGAL TURBINE*—Catalog Section 101 compares unit with conventional centrifugal pump. Gives selection and performance data and installation dimensions for three end-mounted units. Compares end-mounted units to center-mounted units. Gives NPSH characteristics. Five mechanical seals available; pressure and temperature ratings given. *The Roy E. Roth Co., Turbine Pump Div., Rock Island, Ill.*

▸ *RADIO, TWO-WAY*—16 page non-technical guide to two-way radio, "Under the Influence of Radio" (ECR-568A), explains some of the more important FCC licensing requirements. Discusses operational methods. *General Electric Corp., Communication Products Dept., Section P, P.O. Box 4197, Lynchburg, Va.*

▸ *TOOL COMPONENTS, STANDARDIZED*—24 page technical booklet No. 6 describes units and lists application data. Case histories and citing specific examples show use as standard parts for jigs, fixtures, tools, and dies. *PIC Design Corp., 477 Atlantic Ave., East Rockway, L.I., New York.*

▸ *TREATMENT, WATER, FOR HIGH MAKE-UP BOILERS*—10 page Technical Reprint T-183 gives selection data for water treatment for use at different boiler pressures and with different types of water. Examines four basic types of treatment. Discusses case histories of two plants' water treatment requirements. Reviews new treatment and testing methods, including condensate scavenging. Illustrated with tables, flow diagrams, and photos. *Graver Water Conditioning Co., 216 W. 14th St., New York 11.*

RECENT TRADE LITERATURE

Continued

▶ *STOKERS, COAL*—bulletin gives specifications for automatic stokers for coal firing equipment. Capacities up to 1000 lb of coal per hr. Includes stoker net ratings, boiler hp, data on fans used, and data on both fan and stoker drive motors. Illustrated with tables, photos, and diagrams. *The Stokermatic Co., 1610 Industrial Rd., Salt Lake City 4, Utah.*

▶ *STRAINERS*—12 page Catalog No. 6008 describes units for steam, air, gas, and liquids (including cryogenic services). Details over 600 of firm's standard strainers. Pressure drop and pressure-temperature limit data provided. Body materials, end connections, and pressure-temperature ratings in table form for identifying or specifying. *Leslie Co., Strainer Section, 105 Delafield Ave., Lyndhurst, N.J.*

▶ *VALVES, BONNETLESS KNIFE GATE*—four page Bulletin 301 describes firm's units for use on fibrous, viscous, and slurry lines, crystalline and caking sludges, abrasives, and corrosive materials. Each component of valve explained with exploded-view line drawing and brief descriptions. *DeZurik Corp., Sartell, Minn.*

▶ *VENTILATORS, POWER ROOF*—eight page Bulletin DB3-200 covers firm's "Type L-CRF" units. Includes dimensions, capacities, and sound classifications. Describes accessories such as shutters, dampers, disconnect switch and receptacle, air relief vents, and protective coatings. Also describes wall exhaust fan. *Ilg Electric Ventilating Co., 2850 N. Pulaski Rd., Chicago 41.*

▶ *VENTING, GAS APPLIANCES*—handbook of gas vent tables gives complete capacity tables for type "B" large-diameter commercial vent up to 24 in. Tables range up to 10 million Btu per hr appliance input. Covers multi-story application and design, air supply methods, and combined vent design. *William Wallace Co., Metalbestos Div., Belmont, Calif.*

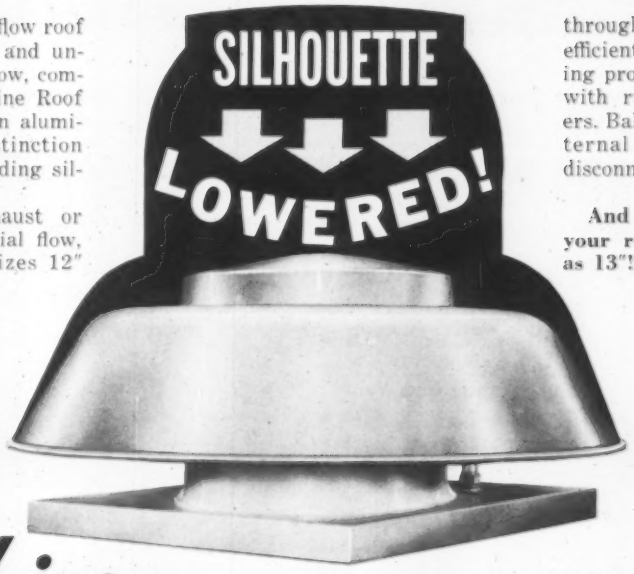
▶ *WELDING, BRAZING, AND SOLDERING ALLOYS AND FLUXES*—wall chart, 19½ × 25½ in. gives selection data of alloys and fluxes according to base metal to be joined. Includes description of firm's aluminum joining alloy line. Each alloy described with recommended pre-heats, amperage or working temperature, tensile or shear strengths, identification, and other data. Government specifications met by firm's aluminum alloys given in tabular form. *All-State Welding Alloys Co., Inc., White Plains, N.Y.*

YOUR ROOF

If you thought an axial flow roof ventilator must be tall and unsightly, forget it. This low, compact, modern Power Line Roof Ventilator, with its spun aluminum housing, adds distinction and beauty to your building silhouette.

Provides superb exhaust or intake performance: axial flow, direct or belt drive, sizes 12" through 36". Truly quiet, highly efficient air-flow. Non-overloading propeller. Full floating drive with rubber vibration dampeners. Ball bearing throughout. External wiring conduit. Safety disconnect switch.

And the overall height above your roof curb can be as low as 13"!

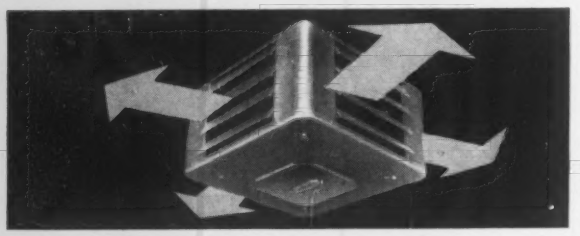


Power Line FAN COMPANY

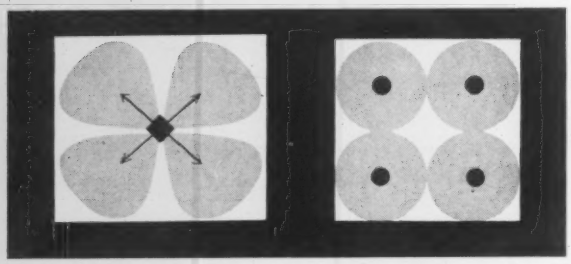
DIVISION OF CHELSEA PRODUCTS, INC.
PLAINFIELD, NEW JERSEY

There's a Power Line Fan for every ventilating problem.

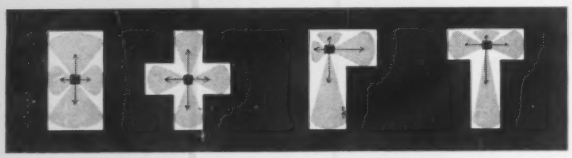
FOR VERSATILITY...LOOK TO CARRIER UNIT HEATERS!



Look! "Clover Leaf" pattern can discharge heated air in as many as four directions at once. One Carrier 4-way heater can be used to do the job of two or more vertical discharge units—or four to six horizontal units.



Look! Using all four of its outlets, the largest Carrier 4-way unit can heat a room over 100 feet square. It takes several vertical discharge heaters to do this same job.



Look! Adjustable louvers make it easy to vary the shape of the "Clover Leaf" air distribution pattern. Without changing outlets or adding accessories, it can be used to heat L, T, I or square-shaped areas.

For a new plant or for modernization, Carrier "Clover Leaf" Unit Heaters can save money three ways—lower installation costs, lower operating costs and lower maintenance costs. Available in eight sizes from 55,000 to 600,000 Btuh . . . for steam or hot water. Carrier offers every type of equipment for any commercial or industrial job: Heat Diffusers and Heating and Ventilating Units for steam and hot water; Unit Heaters for steam and hot water; Gas-fired Unit Heaters and Duct Furnaces. For complete information, call your Carrier representative listed in your Classified Telephone Directory under "Heaters—Unit." Or write Carrier Air Conditioning Company, Syracuse 1, N. Y.

Carrier **Air Conditioning Company**

WE HEAR THAT...

▸ *JOHN ROSS*, Heating, Piping & Air Conditioning author, has been elected president of the *ASSOCIATION OF CONSULTING ENGINEERS OF CANADA*. Mr. Ross was also appointed to a committee set up for U.S.-Canadian consulting relations. F. Spencer Weber was appointed by the *CONSULTING ENGINEERS COUNCIL* to serve on the committee. The balance of the committee is composed of the two executive secretaries of each organization: Col. Muir, of Canada, and George J. Toman, CEC.

▸ *KOPPERS CO., INC.* has purchased controlling interest in the *THOMAS FLEXIBLE COUPLING CO.* to complement its own coupling department.

▸ *AMERICAN VULCATHENE DIV., NALGE CO.* will handle sales and distribution of a new line of corrosion-resistant process piping manufactured by *YORK INDUSTRIAL PLASTICS, INC.* The steel pipe, fittings, pumps, and valves are completely coated with "Penton," a chlorinated polyether resin. The sales territory covers 19 central and northeastern states.

▸ A new regional sales office and warehouse has been established at Linden, N.J. by *DAYTON INDUSTRIAL PRODUCTS CO.* The office will serve 12 northeastern and central states and the District of Columbia.

▸ *MINNESOTA MINING & MANUFACTURING CO.* and a group of gas utilities have joined in a cooperative 18 month development program for the design of pre-production prototypes of a thermoelectric furnace generator. When completed, the unit will allow the furnace to operate without any outside power source.

▸ *SCIAKY BROS., INC.* is moving its research division located in California to Chicago at 4915 W. 67th St., the firm's main plant.

▸ Glenn L. Werly has been named president of the *NATIONAL OIL FUEL INSTITUTE*. The NOFI is the new organization formed by the merger of Oil Heat Institute of America and National Fuel Oil Council.

WE HEAR THAT

Continued

▸ The *CONSULTING ENGINEERS COUNCIL* is offering a booklet describing its purpose, organization, membership, objectives, and accomplishments. Copies are available from the CEC at 326 Reisch Bldg., Springfield, Ill.

▸ *B. F. GOODRICH CO.* will begin commercial production of its "Geon" vinyl. Material is suitable for pipe and fittings, tanks, ductwork, and other applications. It can be extruded, molded, formed, or stamped on existing plastic-processing equipment.

▸ Construction has been completed on an 1800 sq ft addition for the *PENN BOILER DIV., PEBBCO INDUSTRIES INC.* at Lancaster, Pa. The addition is expected to increase the firm's boiler production by at least 30 percent.

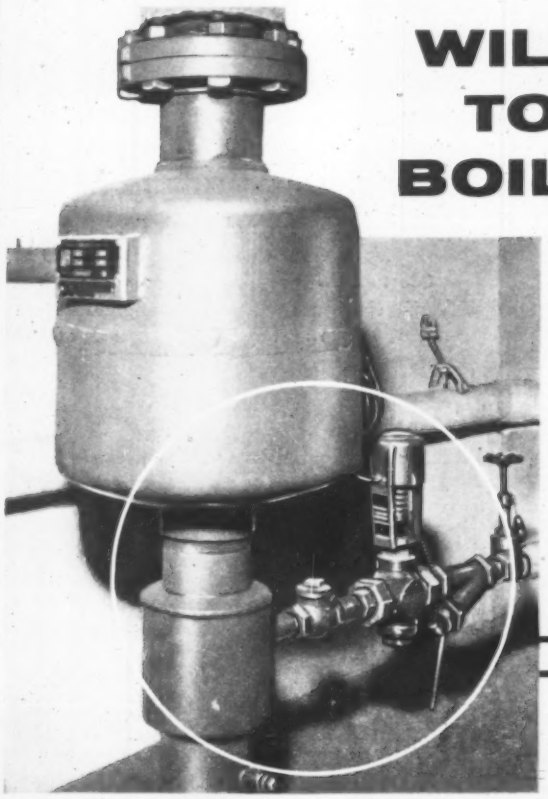
▸ *WEIL-McLAIN CO., INC.* has formed a Canadian affiliate located in Toronto, Ontario. The new firm is a joint stock company with Canadian participation.

▸ *GLEN ALDEN CORP.* has acquired a common stock interest of approximately 30 percent in *REPUBLIC-TRANSCON INDUSTRIES*. As part of the agreement, the *MATHES CO.*, Div. of Glen Alden was sold to Republic-Transcon.

▸ The new officers for *THE MECHANICAL CONTRACTORS ASSOCIATION OF TEXAS* are Joe W. Boyer, president; Clem Mansheim, vice president; Tom Tanner, treasurer; and Jay James, executive secretary.

▸ Fred S. Dubin of *FRED S. DUBIN ASSOCIATES*, consulting engineers, lectured recently at the Pratt Institute in the School of Architecture. Mr. Dubin discussed the engineering considerations in architectural-engineering design, with special attention to mechanical equipment.

▸ *PENNSALT CHEMICALS CORP.* has transferred its sales technical service groups to a new two-story, 31,000 sq ft laboratory in King of Prussia, Pa. The laboratory is the first unit to be completed in the company's planned $6 million technical center.



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A Wilson Centrifugal Blowdown Separator is easy to install —requires no maintenance—instantaneously clears steam flash through the large top vent pipe. Water and sludge fall by gravity through bottom drain. No objectional noise.

To reduce temperature of blowdown before entering sewer, Wilson also provides an economical, easy to install *aftercooler*. No maintenance here, either.

(Shown in the circle) Wilson Aftercooler with thermostatic valve for controlling water supply in the drain—extra equipment available from Wilson.

ASK ABOUT the Wilson Centrifugal Blowoff Separator for high pressure hot water relief valve installation.

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Dept. HA-61

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Power Multuri Gas Burner

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Gas burners for all commercial or industrial process and heating applications are included in the complete Roberts-Gordon line. Whatever your requirements — boilers, furnaces, dryers, heaters — there's a Roberts-Gordon Gas Burner to suit your specifications.

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- **Horizontal Multuri Design Burners—atmospheric and power.**
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- **Time-proven Series 84 Upshot Burner in capacities up to 900,000 BTU/Hr.**

Roberts-Gordon Multuri Burners are multiple venturi inshot units, either atmospheric or power. Standard package units are available, completely wired and assembled, ready for installation. Or, they can be built to your individual specifications. They are designed for easy access to all components for periodic inspection and service. Multuri Burners are available with controls for modulating combustion.

The Series 400 Inshot Burners are ideal for smaller installations. Compact, simplified design with standard thermal or electronic controls. They are available in a variety of models and capacities suitable for a wide range of applications.

Series 84 Upshot Burners feature complete primary and secondary air control. Capacities up to 900,000 BTU/Hr. All Roberts-Gordon burners are equipped with automatic pilots for dependable, sure-fire ignition — trouble-free operation. Special safety devices such as limit, draft and combustion controls can be furnished to suit installation requirements.

Roberts-Gordon Burners have satisfied thousands of users for more than a quarter-century. Be sure of your design — specify an "experience proven" Roberts-Gordon Gas Burner.

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WE HEAR THAT

Continued

▸ April has been declared *NATIONAL WELDED PRODUCTS MONTH* by the *AMERICAN WELDING SOCIETY*. Various governors and mayors throughout the country are expected to make the proclamation official. The month coincides with the 42nd Annual Meeting of AWS and the *INTERNATIONAL INSTITUTE OF WELDING'S* annual assembly — both to be held in New York during this month.

▸ *A. J. INDUSTRIES CORP.* has purchased the Roberts-Gordon Appliances Corp. The firm will operate as a subsidiary of A. J. Industries, continuing under present management.

▸ The *STANDARDS ENGINEERS SOCIETY* has installed its new officers for 1961. Harold R. Terhune is president; Kenneth W. Truhn, vice president; Robert F. Franciose, secretary; and Everett Woerter, treasurer.

▸ *DI-ACRO CORP.* is the new name of the former O'Neil-Irwin Manufacturing Co. The name change was made to create more corporate identity with the firm's brand name and also to signify its trend to diversification.

▸ *FAIRBANKS MORSE & CO.* has made an agreement with W. H. Dorman & Co., Ltd., to market Dorman's line of small, high speed diesel engines. One series consists of units with two, three, four, five, six, and eight cylinders, with a power range from 20 to 200 hp at 800 to 1800 rpm. Another series consists of units with six, eight, and 12 cylinder engines with a power range of 117 to nearly 700 hp at speeds of 800 to 1800 rpm.

▸ *FRED S. DUBIN ASSOCIATES*, consulting engineers, will open a new office in Philadelphia at 138 S. 20th St.

▸ *CERRO CORP.* has acquired the assets of *UNITED PACIFIC ALUMINUM CORP.* The firm will operate as a division of Cerro.

▸ *STANLEY POWER TOOLS* is the new name of Stanley Electric Tools, Div. of The Stanley Works.

MEETINGS & CONVENTIONS

APRIL 10-21 — *American Welding Society's 42nd Annual Convention and Welding Exposition.* Convention at the Sheration-Atlantic Hotel and the Show at the Coliseum, New York. Information: AWS Information Center, 33 W. 39th St., New York 18.

APRIL 23-27 — *Oil Heat Institute of America. 39th Annual Convention.* Statler-Hilton Hotel, Washington, D.C. Information: Francis J. Schuster, convention chairman, OHI, 500 Fifth Ave., New York 36.

MAY 2-4 — *Sixth Biennial Midwest Electrical Industry and Lighting Exposition.* McCormick Place, Chicago. Information: Electric Association, 140 S. Dearborn St., Chicago 3.

MAY 4-6 — *Consulting Engineers Council's Fifth Annual Board of Directors Meeting.* Executive House, Chicago. Information: CEC, 326 Reisch Bldg., Springfield, Ill.

MAY 9-12 — *Mechanical Contractors Association of America Annual Convention.* Fountainebleau Hotel, Miami. Information: MCAA, Suite 570, 45 Rockefeller Plaza, New York 20.

MAY 16-18 — 1961 *Spring Conferences of the Building Research Institute.* Shoreham Hotel, Washington, D.C. Information: Harold Horowitz, BRI, 2101 Constitution Ave., Washington 25, D.C.

MAY 21-23 — *Spring Meeting, Fluid Controls Institute, Inc.* The Cloister, Sea Island, Ga. Information: FCI, P.O. Box 667, Pompano Beach, Fla.

JUNE 4-9 — *Seminar on Electrical Precipitation.* The Pennsylvania State University, University Park, Pa. Information: Conference Center, The Pennsylvania State U., University Park, Pa.

JUNE 8-9 — *First Western Conference, National Electrical Manufacturers Association.* The Biltmore Hotel, Los Angeles. Information: NEMA, 155 E. 44th St., New York 17.

JUNE 11-15 — *The 54th Annual Air Pollution Control Association Meeting.* Hotel Commodore, New York. Information: Sheldon W. Samuels, director of public information, New York State Air Pollution Control Board, 84 Holland Ave., Albany 8, N.Y.

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PERMANENT, CLEANABLE TYPE AG
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EXTRA HEAVY CONSTRUCTION
Provides better thermal mass to resist "burnouts." Offers longer service. Also available in stainless steel enclosing frames.
PRE-ASSEMBLED UNITS for CEILING or Walls
Completely pre-assembled units available . . . just set in place and bolt together. Save time and labor costs. Eliminates complex assembly problems. Available in stainless steel, steel, aluminum.
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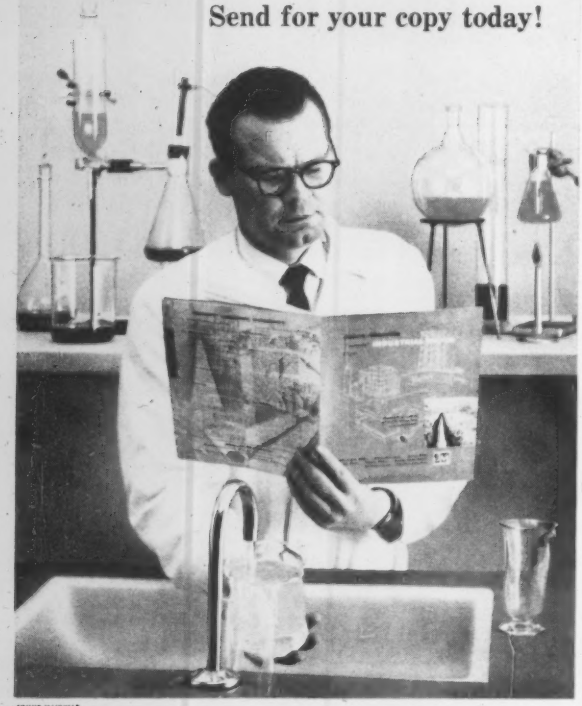

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ADDRESS_____

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COUNTY_____ STATE_____

MEETINGS & CONVENTIONS

Continued

JUNE 12-15 — *National District Heating Association, 52nd Annual Meeting.* Wentworth-by-the-Sea, Portsmouth, N.H. Information: John F. Collins, Jr., secretary-treasurer. NDHA, 827 N. Euclid Ave., Pittsburgh 6.

JUNE 12 — *Air Pollution Instrumentation Symposium,* in conjunction with the *JUNE* 12-16 *Annual Meeting of the Air Pollution Control Association.* Sponsored by ISA and APCA. Hotel Commodore, New York. Information: APCA, 4400 Fifth Ave., Pittsburgh 13.

WEEK OF JUNE 12 — *The Institute of Boiler and Radiator Manufacturers Annual Meeting.* Seaview Country Club, Absecon, N.J. Information: IBR, Room 408, 608 Fifth Ave., New York 20.

JUNE 19-23 — *Air Cleaning Institute.* (see You'll Want to Know, page 52, for details) Harvard University School of Public Health, Boston. Information: Leslie Silverman, SC.D., Harvard School of Public Health, 55 Shattuck St., Boston 15.

JUNE 25-30 — *American Society for Testing Materials Annual Meeting.* Chalfonte-Haddon Hotel, Atlantic City, N.J. Information: ASTM, 1916 Race St., Philadelphia 3.

JUNE 26-28 — *American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Annual Meeting.* Hilton Hotel, Denver, Colo. Information: ASHRAE, 234 Fifth Ave., New York 1.

JULY 18-20 — *Western Plant Maintenance and Engineering Show & Conference.* Pan Pacific Auditorium, Los Angeles. Information: Western Office, 759 Monadnock Bldg., San Francisco 5.

AUGUST 21-31 — *International Exhibition of New Sources of Energy.* To be held concurrently with the *United Nations Conference on New Sources of Energy.* Circo Massimo, Rome. Information: Rassegna Internazionale Elettronica e Nucleare, Via della Scrofa, 14, Rome. (cable address: ROMATOM) Please mark correspondence: International Exhibition of New Sources of Energy.

SEPT. 27-*OCT.* 4 — *The Institute of Heating and Ventilating Engineers, International Conference on Heating, Ventilating and Air Conditioning.* London, England. Information: F. L. Rossetti, secretary, Conference Coordination and Management Committee, 49, Cadogan Sq., London, S.W.1.

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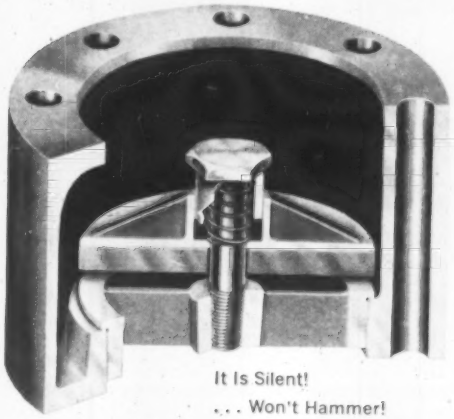

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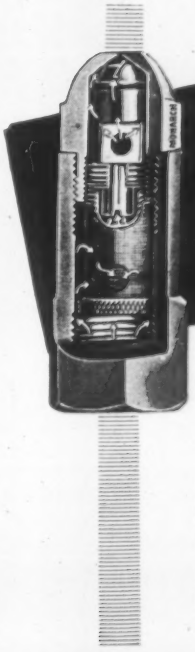

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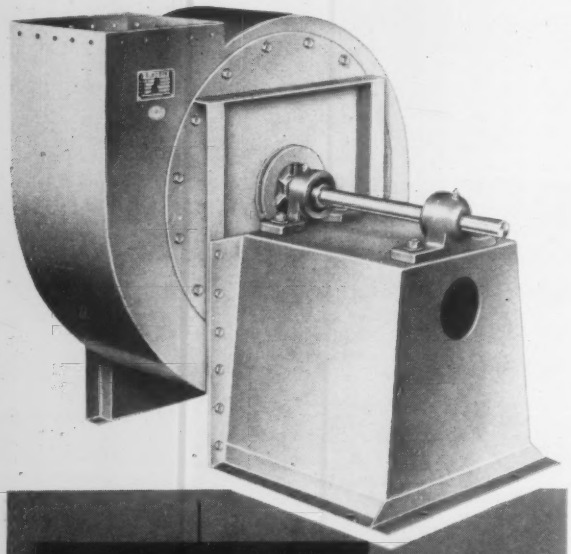

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OCT. 7-10 — *Western Building Industries Exposition.* Great Western Exhibit Center, Los Angeles. Information: WBIE, 2216 S. Hill St., Los Angeles 7.

NOV. 12-15 — *Air-Conditioning and Refrigeration Institute Annual Meeting.* The Homestead, Hot Springs, Va. Information: ARI, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 13-16 — *National Warm Air Heating and Air Conditioning Association Annual Convention.* La Salle Hotel, Chicago. Information: NWAHACA, 640 Engineers Bldg., Cleveland 14.

NOV. 26-*DEC.* 1 — *The American Society of Mechanical Engineers Winter Annual Meeting.* Statler Hilton Hotel, New York. Information: L. S. Dennegar, director of public relations, ASME, 29 W. 39th St., New York 18.

1962

FEB. 12-15 — *Air-Conditioning and Refrigeration Industry 12th Exposition.* Pan-Pacific Auditorium, Los Angeles. Information: George E. Mills, ARI Show Director, ARI, 1346 Connecticut Ave., N.W., Washington 6, D.C.

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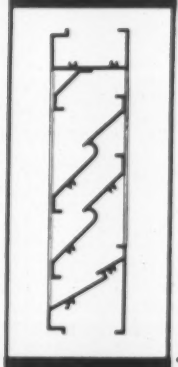

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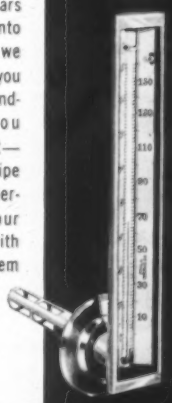

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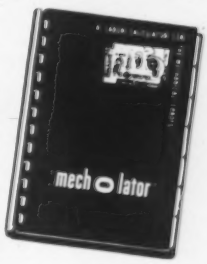

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Engineering and Instrumentation, Journal of Research of the National Bureau of Standards — Reports research and development results of interest chiefly to the engineer and applied scientist. Issued quarterly. January-March issue contains article, "Enthalpy and specific heat of nine corrosion-resistant alloys at high temperature," written by Thomas B. Douglas and Andrew C. Victor. *Superintendent of Documents, U.S. Government Printing Office, Washington* 25, *D.C.* Prices: single copies, 75 cents, yearly subscriptions, $2.25.

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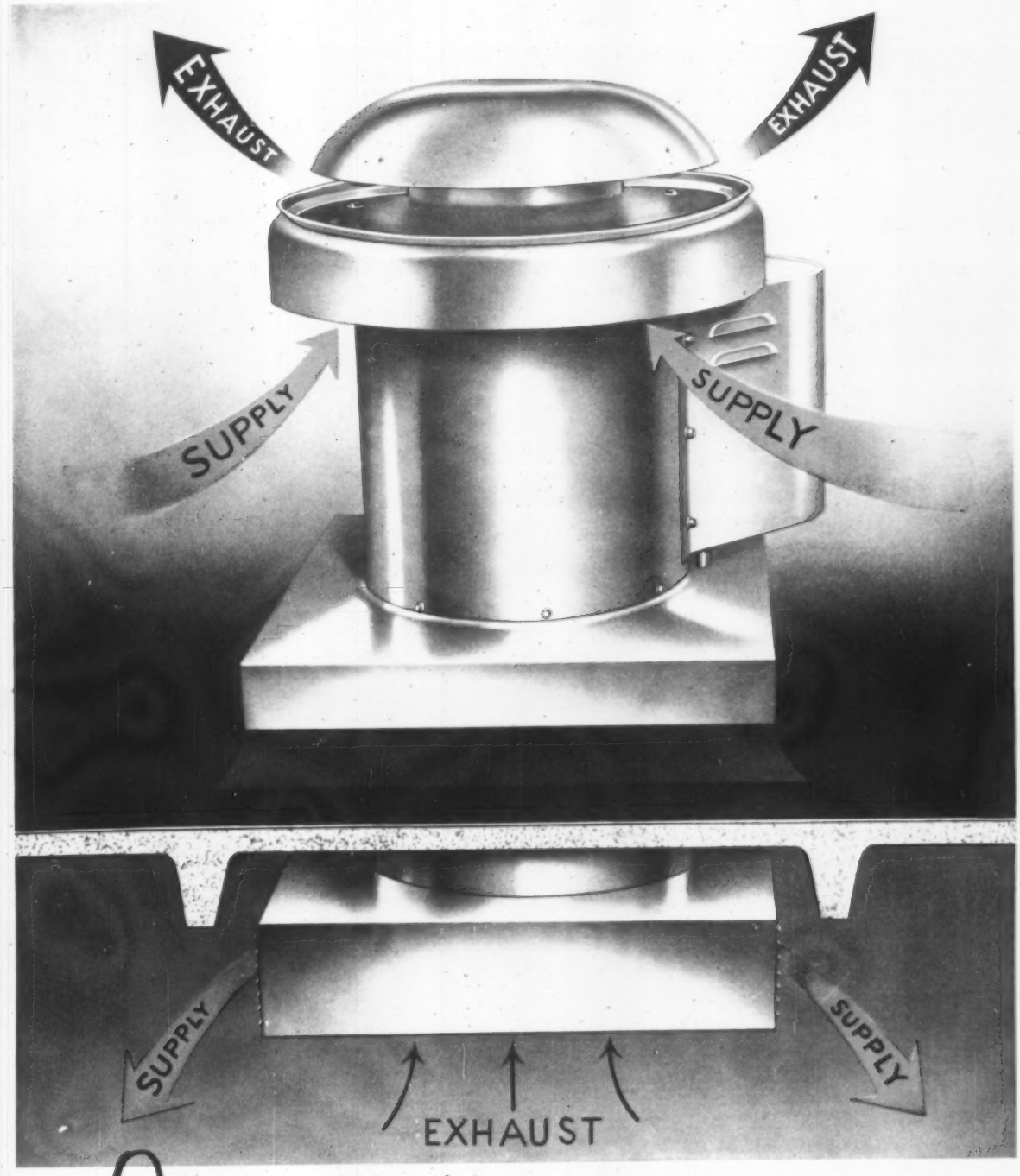

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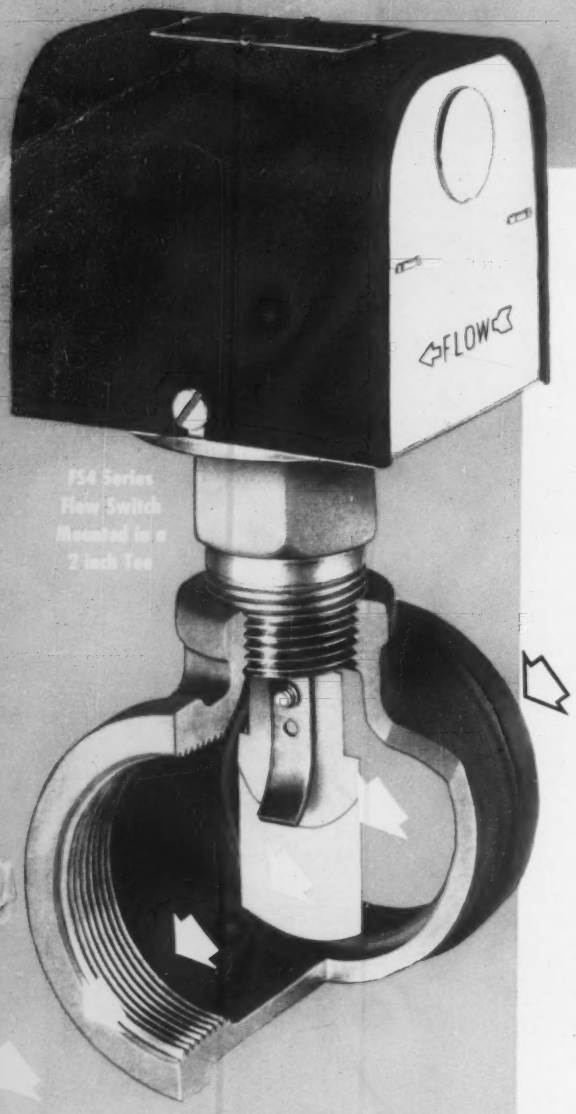
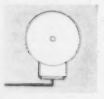
Flow Switches



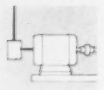
Do you know how many jobs these switches can do?

Look at the FS4 Series Flow Switch illustrated here. What you see is a compact, well-built switch that either makes or breaks a circuit (as required) when liquid flows or stops flowing. Yet in this versatile device you have both the most economical way and the most positive way of starting or stopping a signal, an alarm, a motor, a metering device—anything electrically operated. Just to highlight a few uses:—

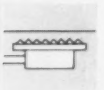
to actuate a signal light—signal an attendant to make the right moves in operating valves, pumps and the like—signal him when flow stops in a water cooled compressor, water cooled bearing and so on.



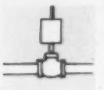
to sound an alarm—when flow stops in a process system or in any water cooled devices.



to start or stop motors—start pumps in sequence in multiple stage flow systems; start standby pumps; stop automatically controlled units if cooling water system fails; stop compressors in cooling systems when flow stops. These are *control* functions, and almost endless.



to start or stop automatic burners—start a booster heater when water draw occurs; stop burner if flow is improperly retarded; make sure of circulation in a boiler before burner is permitted to start.



to actuate metering devices—open valve in chemical feeder line; start mixing in secondary line whenever flow starts in primary line.

Think it over! Some of these uses may suggest some related problem the FS4 can solve for you right now. Notice the facts about its construction and service range opposite.

McDonnell quality throughout:

Compact switch with positive snap action. Removable cover and two knockouts for easy wiring. Phosphor bronze sylphon seals assembly leak-tight from line. Paddle made in segments to fit any pipe from 1" through 3". FS4 series, illustrated, is for maximum working pressure 100 psi; maximum temperature, 300° F., in types as follows:

FS4-3 Single pole, double throw switch. Opens and closes two separate circuits with flow. Closes and opens same two circuits with no flow.

FS4 Closes with flow, opens with no flow.

FS4R Opens with flow, closes with no flow.

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